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EXPERIMENTS WITH COCONUTS.

An interesting series of experiments, an account of which, taken from Bulletin No. 77 of the Department of Agriculture of Trinidad and Tobago, appeared in the TROPICAL AGRICULTURIST for November, 1914, is in progress in the Island of Tobago in the West Indies. Manures were applied in 1911 and records for the two years 1911-12 and 1912-13 have been published, but the experiments are being conducted on five different estates so that the records are those of each mixture repeated ten times. We select for examination four plots which we may describe as 1, Potash plot; 2, Phosphoric Acid; 4, Nitrogen and Phosphoric acid and 5, Nitrogen and Potash. There are unfortunately complications from our point of view of determining the relative influences of the three principal plant foods upon coconut crops because different manures were used for supplying the same ingredients: 1, Lime and Kainit; 2, Basic Slag and Sulphate of Potash; 4, Basic Slag and Nitrate of Soda; 5, Calcium cyanamide (nitrolim) and Sulphate of Potash. The mean of control plots Nos. 3 and 6 is added for comparison in the following table :—

Plot.	1911-12 nuts per tree	Relative yield	1912-13 nuts per tree	Relative yield	1913-14 nuts per tree	Relative yield	Average 3 years nuts per tree	Relative yield
3 & 6 Control	70	100	56	80	67	96	64	91
1. Lime and Potash	74	106	63	90	63	90	67	96
2. Phosphoric Acid and Potash	71	101	56	80	58	83	62	89
4. Nitrogen and Phosphoric Acid	68	97	63	90	69	99	67	96
5. Nitrogen and Potash	83	119	68	97	84	120	78	111

RELATIVE YIELD IS COMPARISON WITH YIELD OF CONTROL IN 1911—12.

The results so far indicate the superiority of Nitrogen and Potash in combination (Plot 5) over that of any combination of Phosphoric acid though we must await further results before being able to say whether it is Nitrogen or Potash that is exerting the greatest influence.

The nitrogen was applied as Nitrolim, the Potash as the Sulphate. This plot was given twice as much potash and about 1/3rd the amount of lime as plot 1—Lime and Kainit. Lime would certainly appear to have played a successful part in these results as far as they have gone.

The results of the Peradeniya Coconut manuring experiments were published in Bulletin No. 10 of May, 1914. These experiments were started in 1909 to determine whether trees over 50 years of age would respond profitably to cultivation and manuring, and if so what treatment. They are not therefore quite comparable with the Tobago experiments which have been with trees between 21 and 36 years old—in their prime; but they provide some useful experience. We confine our examination again to the effect of nitrogenous, potassic and phosphatic manures, that is to say, plots 2 Sulphate of Potash, 3 Nitrate of Soda, 4 Concentrated Superphosphate, and 14 and 15 Controls. Results are available for three years. Relative yield is comparison with yield of control for 1911 :—

Plot.	1911		1912		1913		Average 3 years nuts per tree.	Relative yield.
	Nuts per tree.	Relative yield.	Nuts per tree.	Relative yield.	Nuts per tree.	Relative yield.		
14 & 15 Control	27	100	24	89	23	85	25	93
2. Potash	25	93	34	130	29	107	29	107
3. Nitrogen	17	63	19	70	17	63	18	67
4. Phosphoric acid	24	89	26	96	27	100	26	96

The potash plot comes out well ahead confirming the results obtained at Tobago of the influence of Potash; nitrogen is last and it is significant that it was applied as nitrate of soda which did not do well in Tobago.

The belief that common salt is specially beneficial as a manure for coconuts is not supported by any experiments in the field as far as we are aware. Salt does benefit certain crops ; the sodium being able to a limited extent to take the place of potassium especially when there is a deficiency of the latter. It is believed also that salt releases potash in the soil for the use of the plant ; but there are, we think, no grounds for supposing that coconuts derive particular benefit from salt because of their maritime origin. At Peradeniya the salt plot gave an average of 28·5 nuts per tree in 1913 compared with 28·6 of the potash plot, but it started off with a yield of 54 in 1911 ; thus declining 47 per cent. The potash plot on the other hand rose from 24·7 to 28·6 : an increase of 16 per cent.

The case of the coconut plant is not quite on all fours with that of rubber, cocoa and other arborescent plants that have large anchoring roots near the surface precluding the use of the plough which, with the harrow, is probably the most effective means, with the majority of soils, at the disposal of the planter for securing healthy trees and good crops. The fibrous roots of the coconut yield to the plough, which causes no material injury to the palm by cutting them. On the contrary, by forcing the tree to develop root growth deeper down it probably benefits it.

At Mahailuppalama a young plantation of 17 acres which has been ploughed twice a year and harrowed about once a month, yielded at the rate of $11\frac{1}{2}$ nuts a tree in 1914 – six years after planting. It has had the water turned on twice a year to soften the ground before ploughing, and during the first three years the young plants were irrigated during the dry season. 29 per cent. of the trees are in bearing.

On the same plantation, which is in the Dry Zone, $6\frac{1}{2}$ acres of coconuts, 7 years old, yielded in 1914 at the rate of only $2\frac{3}{4}$ nuts per tree. This plantation had not been ploughed and harrowed but only weeded ; nor has it been irrigated, though the young plants were watered from time to time in the dry seasons during the first two years. 12 per cent. of the trees are in bearing.

Thus under the plough and harrow the younger plantation, cultivated mainly on dry farming principles, has completely overtaken the older. The good effects of this cultivation are further

reflected in the quality of the nuts. In the ploughed plantation an average of 1,239 nuts were required for a candy (560 lb.) of copra in 1914 ; in the uncultivated, 1,510 nuts.

The Department of Agriculture has now in hand seven sets of coconut experiments—at Peradeniya (3), Mahailuppalama (1), Negombo (1), Chilaw (1), and Pitiakande, Kurunegalla (1). Two have been planned to test the value of dry farming principles in the up-bringing of a plantation ; one the influence of the most important manurial constituents with young palms on poor sandy soil not amenable to dry farming methods ; the others are mainly to determine what are the best manures for trees of bearing age.

The Negombo experiments are being carried out by MUDALIYAR A. E. RAJAPAKSE ; the Pitiakande by MR. C. DE E. COLLIN, Superintendent for the North-Western Co.

One of the earliest among planters in Ceylon to recognise the value of manures for coconut trees was MUDALIYAR A. E. RAJAPAKSE of Negombo, whose results were published about the year 1908. The experiments do not come within the category with which this series of reviews is particularly concerned because they were not planned to determine the relative value of the principal manurial ingredients or of definite methods of cultivation, but to demonstrate the value to the palm of artificial manures in general. An estate of 3,500 trees, described as very old, with very thin trunks, on gravelly soil, in the Galle District, was treated with a mixed manure in 1900, again in 1903 and a third time in 1905. The yield was raised from an average of 11 nuts per tree in 1900 to one of 45 in 1907. MR. HENRY DE MEL, Honorary Secretary of the Low-country Products Association, is conducting some experiments on similar lines on the Imbulgaswadia Estate, Negombo, where he has had 70 acres under general mixtures since 1910. In that year the yield of copra was at the rate of 896 lb. per acre ; in 1914 the yield was 1,560 lb. per acre ; a rise of 74 per cent. over 1910. These two experiments illustrate in a decisive manner the value of applications of artificial manures to coconut plantations.

R. N. L.

RUBBER.

PROBABLE EFFECT OF THE WAR ON THE RUBBER POSITION.

MR. HERBERT WRIGHT, Chairman of the Bandar Sumatra Rubber Company, in the course of an address at the fifth annual ordinary general meeting of the company said : " I propose on this occasion to deal with various problems resulting from the present war. I take it for granted that we are prepared, at a great sacrifice, to support the Government in any steps they may take with the object of extinguishing the supply of any commodity which may assist the enemy, and in maintaining supplies for this country and the Allies. The two products of our estates, coffee and rubber, are contraband, and we have already had considerable anxiety in connection with them. Rubber, we know beyond any shadow of doubt, is as essential to success in war as petrol or copper. Without rubber the transport of men, food, and apparatus would be very seriously delayed. The manufactured stocks of enemies, known to be phenomenally large in June of this year, are now practically depleted. Without further supplies of rubber the enemy will be crippled to an extent which few of us can comprehend.

" I also assume that you are all aware of the practical measures taken by our Government, first in arranging that all plantation supplies be consigned to London, and then, in virtue of our supremacy at sea, prohibiting the re-export of crude rubber to any port. Without wishing to prejudice or even criticise the action of our Government, I will give you some information which I think will interest you. I will show you the British position in the past, the new position created by the war, and the possible effect, on plantation owners, of recent legislation. In the first place, I want you to realise that America annually imports and consumes more rubber—about 50,000 tons—than any other country. Next come, in order of tonnage consumed, the United Kingdom, followed by Germany, Russia, France, Austria-Hungary, Italy and Japan, The United States is the biggest consumer of plantation rubber. I estimate that under normal circumstances, allowing for the preference which large United States consumers naturally have for plantation rubber, that they would require for 1915 quite 30,000 tons of our product, the rest, amounting to 20,000 tons, would be Brazilian and African grades. During war they could do with a great deal more plantation rubber. As you are aware, an increased tonnage compared with 1914 has been sold by plantations c.i.f. New York, for delivery during 1915."

GERMANY IS OUR NEXT BIGGEST CONSUMER.

" In 1913 she received from Great Britain alone nearly 10,000 tons of rubber; in the first half of this year she received from the United Kingdom and our Colonies 4,500 tons, and also half that quantity from Brazil. Her next biggest source has been her own colonies in German East Africa, the Cameroons, and Togoland. A fair proportion of her imported rubber was re-exported to foreign countries. Under present conditions she can receive practically

no rubber, neither can she export the crude or manufactured article. The point which I wish to make is that hitherto Germany has been very dependent on British territory for her supplies of raw rubber, and has received very little from the United States. Similarly, with regard to Austria-Hungary, we have been the biggest suppliers of crude rubber. Russia was supplied with about 6,300 tons in 1913, and France with over 5,000 tons, from the United Kingdom alone. Japan has called for a small but still significant supply from us. Now during the second half of this year there has been practically no supply to the enemy, but a big increase in exports to the Allies and to the United States and other neutral nations. You will, therefore, see that the British have, on the old lines, supplied the rest of the world with large quantities of rubber. Ourselves and the Allies use 35 per cent., the enemy 17 per cent., and the neutral nations 48 per cent. of the world's rubber.

WHAT NEW LAW MEANS.

"But of the world's supplies, owing to the action of the Government, we directly control the main crop—plantation—equal to 45 per cent.; we also indirectly control that from Africa—say 15 per cent.—and may have an influence on the tropical American crop, averaging 40 per cent. of the world's supplies. Next year, owing to the increased age and acreage of bearing trees on Eastern plantations, and the elimination for the time being of the produce from German Colonies, we may directly control 60 per cent. of the world's supply, and exert a big influence on the ultimate destination of the rest. But the new law also means that we shall not only control more rubber, but, if necessary, accumulate it. During 1915, the United Kingdom will, if the present regulations are enforced, import from the East about 72,500 tons of plantation rubber plus a large tonnage of African and Brazilian grades. Of this I estimate that the United Kingdom, Russia, France, and Japan will require about 50,000 tons; this will leave us with over 20,000 tons minimum of plantation rubber for export to neutral nations. Such a vast surplus, increasing month by month, would mean a fall in price of plantation rubber. The day prior to prohibition being announced, smoked sheet and fine hard Para were about the same in price; to-day fine hard Para is 2*s.* 8½*d.*, per lb., plantation crepe 2*s.* 1½*d.*, and smoked sheet 2*s.* 4*d.* per lb. Fortunately there was very little plantation rubber available when prohibition was declared. If plantation supplies arrive in regular quantities, and the present regulation operates throughout 1915, and no shipments are possible to the United States and other neutral countries, there is no limit to which rubber may fall in the absence of any co-operation among producers. And I have no faith in concerted action among growers except or until the position of the biggest or wealthiest producers is seriously threatened. You can see that plantation rubber could easily become unprofitable to collect. This would mean that labour on eastern estates would have to be much reduced or put on short time, or the estates conducted as before, but at a loss. You know as well as I do that we must, as business men, be prepared to run our estates in first class condition at a loss if it is necessary to do so. The position will remain serious until the United States of America agree to take our rubber on our terms.

"I hope you do not regard my remarks as being too pessimistic. I am, so far as plantation rubber is concerned, an optimist. But I think we must not

be afraid to face unusual conditions and act accordingly. The total crops I have mentioned may strike some of you as being very large ; but I am not at all afraid, providing neutral trade can be maintained, and old credits are re-established. I can assure you that the manner in which credits have been affected will appreciably diminish the output, not merely from plantations, but also from wild areas, unless in the immediate future neutral nations are compelled to depend absolutely on wild rubber. Furthermore, the war has taught us, above all things, what rapidity of transport means. It has taught us the enormous importance of motor transport, in which rubber tyres are essential. There will be, after the war, a boom in all manner of manufactured rubber articles ; because practically every firm in the enemy country has had its manufactured stocks depleted, as well as its supply of crude material. The wastage of rubber tyres, valves, boots, waterproof, surgical and numerous other articles, the extinguishing or disorganising of supplies from certain rubber-yielding areas previously owned by the enemy, and the necessity of replenishing stocks of crude rubber, may result in a demand for our product which will be phenomenal. The year after war terminates I fully expect that, if credits are re-established, you will have to sell Germany 35,000 tons of rubber, and every Continental power will want double the usual supply to make good the depleted stocks. I could relate details of how the 117 tons of rubber in Antwerp, the day after the fall of that city, were urgently purchased at 12 marks per kilo by Germany, who would, I believe, have willingly paid a higher price for fifty times that amount.

"Some of you may be interested to learn how I arrive at my figures for next year's crop of plantation rubber. The total will not be up to my estimate if there is any restriction of tapping operations ; it will be increased if rubber rises much higher in price. It is based on the assumption that all acreages planted during and prior to 1909 will be in bearing in 1915, and after allowing for varying yields of 220 lb. per acre per annum from Java, Ceylon, South India and Borneo, of 250 lb. per acre per annum from Sumatra, and of 300 lb. per acre per annum from Malaya, my estimate totals to 72,500 tons for 1915, if tapping operations are normal. There was not any great increase in planted acreage between 1908 and 1909, hence the small estimated increase in crops. In fact, a shortage would have been likely next year, because the average rate in increased consumption would have been greater than that in plantation supplies—the only source expected to show an increase. The war may, of course, materially affect supplies from all parts of the tropical world."—

INDIA RUBBER JOURNAL.

CLEAN PACKING

PHILIP SCHIDROWITZ.

The desirability of packing plantation rubber in such a manner as to exclude contamination with wood splinters, dust, etc., has been so frequently discussed, that it is not a little remarkable that so far very little, in a practical way, has been attempted in this direction. Tea, an article which sells down to about 4*d*. per lb., is carefully packed in lead foil ; plantation rubber worth, even in these times, 2*s*. per lb. is stowed, unprotected, in wooden cases.

Planters should bear in mind the fact that one of the greatest advantages of the plantation over the wild article is that it can—or should—for most purposes be used without washing in the factory. The expense involved in washing and drying rubber at the works is considerable, but quite apart from this, the washing operations undoubtedly affect quality. Experience has shown that a comparison between wild and plantation rubbers, when both varieties have been factory washed, does not necessarily give an accurate idea of the relative value of the two articles. Wild rubber must be washed; plantation, if clean and dry, can, for the manufacture of most goods, be taken straight to the mixing rolls. There is no reason why *all grades, including earth and tree scrap, of plantation rubber* should not be sent home absolutely clean and ready for use. As a very simple and inexpensive solution of the packing problem I suggest that the cases should contain a loose liner of cloth, simply folded over the top. These cloths could be readily washed and returned with the empty cases or separately. The cloth should be of the type so widely used in rubber works for calendering and wrapping, etc. Well boiled, this type of cloth sheds no "fluff," and the mere fact that it is used all through the factory is sufficient evidence of its practicability in this connection. The cost of these cloth liners would be infinitesimal. I suggest to dealers that they should approach manufacturers and offer them naturally after coming to some suitable arrangement with producers plantation rubber packed in the manner suggested at, say, 1/16th of a penny per pound over goods packed in cases in the ordinary way; or alternatively that planters should take the bull by the horns, and send home small consignments put up as indicated. I feel sure they would find it well worth their while.—INDIA RUBBER JOURNAL.

HOW EXPENDITURE ON ESTATES CAN BE REDUCED.

CYRIL BAXENDALE.

Throughout its history there has never been such an opportunity for those connected with the British rubber industry to render service to their country's cause. The public-spirited part played by the Rubber Growers' Association in the proceedings which led to rubber being declared contraband must result in a further curtailment of the demand; but the loss that producers will sustain on this account is likely to be trifling as compared with the inconvenience suffered by the enemy when he lacks one of the essential ingredients required for the manufacture of that peculiar compound known as "Modern Warfare." At the same time we have again been privileged to give the lie to the ancient story that the "shop-keeping" Briton sets purse above patriotism.

The question we have to consider now is, What steps can be taken to minimize the weight of that sacrifice.

Our manufacturers have a magnificent opportunity, and one can only hope that they are turning it to the best advantage. The rapid fulfilment of orders for the various necessities of the Allied Armies in the field ranks before every other consideration.

The producer's position is far more complicated. The enemy (like ourselves) believes he is fighting for his national existence, and the struggle may last for years. The wastage of rubber in war is bound to be great; but the requirements for peaceful purposes will in all probability be curtailed, and the maintenance of a steady value is a matter of first importance. Any considerable shortage in the immediate future would send the value up to a figure which might embarrass the manufacturer with large Service contracts to fulfil, and would very shortly lead to an over-supply, causing the pendulum to swing so far the other way that small producers, or those without large cash reserves, would be unable to maintain their existence.

Last month's imports show a reduction compared with the same month last year, and the prices prove that supplies were not in excess of the demand. It is therefore conceivable that the closing down of the healthy rubber estate might be as great a loss to Britain as the sinking of one of her merchant vessels. So long as the demand keeps pace with the supply, all is well; but we should be prepared for a less satisfactory position.

It has been sufficiently demonstrated that the majority of mature estates cannot under present labour conditions introduce further general economies without a reduction in efficiency; but with a great many it is possible to reduce the cost of tapping, provided the owners are prepared to face a temporary reduction in output. This can be done in two ways, and both will tend to the ultimate advantage of the estate, when the market is ready to deal with larger supplies. Firstly, by reducing the number of cuts, and (or) increasing the interval between tapping; and, secondly, by cutting out the least profitable trees. Thanks to the adaptability of the Hevea tree, if the former policy be adopted in a reasonable way, a reduction in costs is assured, while thinning out will result in a better development of the survivors which in course of time will fully compensate for the immediate sacrifice.

I am confident that the majority of estate managers fully recognize the ultimate advantage of the reforms suggested above, but many fail to press their views sufficiently, because they are aware that shareholders are usually more interested in the current year's dividend than in the future welfare of their properties. It is impossible to believe that if shareholders in general could be taught to realize the situation they would fail to appreciate it and not insist on a more conservative policy in spite of the temporary loss. Those managers who have the welfare of their estates most at heart are continually criticized by shareholders who expect the yield to rise automatically every month, and judge the value of the estate and success of the administration by the amount of the dividend.

For example, roughly speaking the difference in cost of tapping every day and on alternate days is about two-pence a pound in favour of the latter, when the trees have become accustomed to the change of system, but if this saving in labour involves in the first year (say) a reduction of about one-quarter in the yield, the profits are bound to be less with rubber selling at its present price. On the other hand, it is quite conceivable that the rubber may fall to such a price that the estate producing 300 lb. of rubber will be more profitable than the one producing 400 lb. if the former's costs are only one penny a pound less.

I am not advocating a curtailment of supplies while there is a steady demand at present prices, but I consider it the positive duty of every director of plantation companies to impress upon his shareholders that if a reduction in their estates output becomes necessary, it need not prove to their ultimate disadvantage.—INDIA RUBBER JOURNAL.

COCONUTS.

CATERPILLARS ON COCONUTS.

P. B. RICHARDS.

In June of this year (1914) a caterpillar pest was reported to be damaging coconut palms on an estate on the West Coast. A visit to the estate showed that the attack was of considerable importance. Experiments were made in control methods which, it is hoped, will be the foundation for more extended work. The results so far obtained are not final, but they indicate very clearly the value of spraying with an insoluble arsenic compound. As a similar attack may occur on any coconut plantation in the Peninsula, it is thought advisable to publish a brief account of the pest at once.

The caterpillars causing the damage are the larvæ of skipper butterflies. Chrysalids collected by MR. NORRIS, and larvæ which were fed in the laboratory of the Department, produced three species of butterflies belonging to the family Hesperiidæ, which were identified by MR. HOLMAN HUNT as *Hidari irava*, *Erionota thrax* and *Corona palmarum*.

The first two are widespread throughout the Malay Peninsula, feeding on wild palms. A sufficient number was not obtained to warrant an estimate of their relative proportion in the attack. *Hidari irava* has been previously recorded as a pest of coconuts in this country.

The life history of none of the species has yet been worked out in detail. The main features are as follows :—

Eggs are laid on both upper and lower sides of the coconut palm fronds. The eggs are roughly hemispherical. The young larvæ are elongate, green, naked, the head pale brown, the prothorax, just behind the head, compressed, giving the appearance of a neck. Older larvæ have the head dark brown and the body greyish green with a slight mealyness over the whole surface. The pupa is long, cylindrical, tapering to hind end. Pupation takes place in the folded leaf. The life history is short, probably from six to eight weeks.

The nature of the damage to coconut palms is characteristic. The larva connects together with stout soil adhesives the two edges of the underside of one pinna, or the underside of one to the top of the next, forming a tunnel in which it lives and feeds. The caterpillar feeds towards the rachis, and the result of a bad attack is that the pinnæ of each frond are stripped to the midrib, half way or more towards the rachin. No preference appears to be shown for young or old leaves, all being attacked. Young coconut palm of a few months are attacked equally with palms in bearing. Palms which have been badly attacked have a very ragged appearance.

The caterpillar, when feeding, devours the whole of the tissue of the leaf-segment which forms its tunnel, with the exception of the central supporting rib. It is evident, therefore, that if a poison be applied over the whole of the leaf, so that the caterpillar is compelled to eat the poison or to starve, the attack will be checked. The poison used must be insoluble and

adhesive, to withstand tropical rain, and it must be inocuous to the foliage. These conditions are best met by lead arsenate. This substance can be obtained in a very fine state of division, in the form of a paste. When mixed with water, a uniform spray fluid is obtained, capable of being sprayed as a fine mist. A very small quantity suffices to kill the caterpillar, and the cost of the material is small.

To make the spray fluid 1½ lb. of lead arsenate paste, equivalent, roughly, to 1 lb. of lead arsenate, is mixed with sixty gallons of water. Ten pounds of slaked lime may with advantage be added, as this increases the covering power of the mixture, and prevents any soluble arsenic which may be present from burning the foliage. Any sprayer with a nozzle giving a fine misty spray may be used for applying the poison. All the leaves should be sprayed as evenly and fully as possible, and spraying should cease as soon as any tendency to drip is observed. The dryer the day, the better for spraying. Once the spray has dried on to the leaf it is very adhesive, retaining its toxic properties for weeks notwithstanding subsequent rain.

Immediately an attack is observed, spraying should be commenced. If the young caterpillars are dealt with immediately after hatching, all the foliage will be saved. Delayed treatment results in loss of leaf area, and may allow the caterpillar time to have fed sufficiently to be able to pupate instead of feeding further upon the poisoned foliage.

The quantity of spray fluid required and the nature of the spraying machine depend upon the size of the attacked palm. For palms up to about 7½ feet high, a knapsack sprayer with extended nozzle is efficient. Above this height, a manual or power pump is required. Young palms up to a year old require from four to eight gallons of spray fluid per hundred palms. Full grown coconut palms require nearly half a gallon per palm.

Lead arsenate paste containing 60 per cent. lead arsenate, should be obtainable in quantity at about forty cents a pound.

If the caterpillars are fully grown before work is commenced, it is useless to spray until the next generation. A very small proportion only would be affected by the poison, the majority refusing to feed, and ultimately pupating. Good work may then be done by collecting the pupæ and placing them in a box, one side of which is replaced by wire netting of quarter inch mesh. A varying proportion of the larvæ are always attacked by insect parasites which do not emerge until the caterpillar has pupated. These parasitic insects are always much smaller than the host butterfly. Butterflies and parasites emerge from the collected pupæ. The parasites escape to continue their attack upon the pest, whereas the butterflies, unable to pass through the small mesh, remain in the box and die.

The hatching box should be made inaccessible to ants, or the pupæ will be destroyed before hatching.—F.M.S. AGRICULTURAL BULLETIN.

COCONUTS AT MAHAILUPPALAMA.

The eleventh and last picking of 1914 was made on January 17th, 1915. The number of nuts collected was 900 from 278 trees. This gives a total of 15,451 nuts for the year 1914 from an area of 23½ acres, composed of plot A, 17 acres of 6 years old and plot B, 6½ acres of 7 year old trees (number of trees per acre 70).

In the cultivated area (6 year old trees) consisting of 1,224 trees, 259 trees gave 839 nuts, an average of 3·25 nuts per tree.

In the uncultivated area (7 year old trees) consisting of 449 trees, 19 trees gave 61 nuts, an average of 3·25 nuts per tree.

CROP RETURN FOR THE YEAR 1914.

Yield of nuts per tree per annum. When based upon the total number of trees, including those not in bearing, is as follows —

Plot A	...	...	11·5 nuts
Plot B	...	...	2·75 ,,

The monsoon rains ceased on January 14th and the chief operations now are :—

1. Ploughing between the rows.
2. Weeding and hoeing round the trees
3. Planting.

Five acres of young coconuts have been planted just in front of the Conductor's bungalow.

Method of planting: 30 feet × 30 feet.

G. HARBORD,

Manager, Experiment Station, Mahailuppalama.

LOW-COUNTRY PRODUCTS ASSOCIATION OF CEYLON.

We have been favoured by the Honorary Secretary with a copy of the Annual Report of the Low-country Products Association of Ceylon for the year ending 31st December, 1914. The report contains, in addition to other information, articles on The Trade in the Products of the Coconut Palm in Ceylon and The Trade in Palm Kernels. The former of these from the pen of DR. H. M. FERNANDO which we reproduce below will be found of interest to the readers of the TROPICAL AGRICULTURIST :—

THE TRADE IN THE PRODUCTS OF THE COCONUT PALM IN CEYLON.

Of the three great agricultural industries of Ceylon the cultivation of the Coconut Palm is the most important, both in the extent of the area involved, and in the magnitude of its benefits to the colony.

According to the latest statistics, the extent of the area cultivated with Tea amounts to 409,500 acres valued at £16,000,000; that of Rubber to 240,500 acres valued at £12,025,000; whereas the area under Coconut Palm is estimated at 800,000 acres which may be valued at £40,000,000. Moreover, palm growing is almost entirely in the hands of the permanent population, financed with local capital, and worked principally with indigenous labour.

The outstanding feature of the coconut industry in Ceylon is the variety and number of its products that have been exploited for exportation. Whereas in all the other Islands in the equatorial belt where the coconut palm thrives, the only article of export is copra, Ceylon has succeeded in establishing the following products in its export trade viz:—

(a) Copra of the dried kernels.

(b) Coconut oil, which is expressed from copra.

(c) Desiccated nut which consists of shredded or disintegrated kernels, dried rapidly by machinery, for use in confectionery and in biscuit making.

(d) Poonac or oil cake, the residue left after the extraction of oil from the copra.

(e) Coconut fibre and yarn obtained from the husks which cover the nuts.

Of these products the amount and value of export from Ceylon in 1913 and the quantity exported in 1914 are as follows, viz:—

	1913.			1914.	
Copra tons	55,864	value Rs.	20,959,206	tons	65,709
Oil ,,	27,349	,, ,,	16,737,710	,,	23,434
Desiccated nuts tons	15,190	,, ,,	7,866,723	,,	15,045
Poonac tons	11,834	,, ,,	1,093,643	,,	8,761
Fresh Nuts	No. 16,861,324	,, ,,	1,291,352		No. 11,086,369
Coir Matting packages	392	,, ,,	5,663		———
Rope tons	1,021	,, ,,	204,250		———
Coir Yarn tons	5,754	,, ,,	1,561,687	,, tons	4,884
Coir Fibre ,,	12,699	,, ,,	1,567,173	,, ,,	10,824
	Total	Rs.	51,287,407		

Of the copra exported the greater part is prepared on the plantations by expert driers who work on contract rates. They are provided with a kiln and a store in each estate. The best grades are obtained by exclusive sun drying in such dry districts as Kalpentyn, but in well-managed estates in the Chilaw and Negombo Districts equally high grade copra is produced by kiln drying after a few days exposure to the sun. The cost of manufacture is remarkably small, ranging between Rs. 8·00 to Rs. 12·00 a ton. In several text books recently published in London on the cultivation of the coconut palm, many suggestions have been made for improving the quality of copra by substituting costly machinery in place of the simple and economical process now obtaining in Ceylon. The experience of this colony is against the use of such machinery. Copra produced by such methods will not command a price sufficiently high to counterbalance the enhanced cost. The produce of the small gardens is generally sold to the nearest rice dealer, who then converts such produce into copra. The copra, whether made on the estates or by traders reaches Colombo for sale, where there is a daily market and, in normal times, a keen competition for its purchase by those engaged in its export and by the local crushers for its oil. Three qualities are recognised in the Colombo copra market. The highest prices are given to the grades known as Kalpentyn and estate. Marawilla comes next, and finally cart copra, the produce of small traders.

Ceylon copra commands a higher price in the European markets, often two or three pounds a ton, more than the produce exported from Singapore or Manila. This, despite the fact that some of the Ceylon exporters do not confine their export to the best grade only. If the manufacturers in Europe are prepared to pay still higher prices for a better class of produce, copra of higher quality than the average product now supplied to the Colombo market will soon be forthcoming. But this is far from the case. On the contrary the United Kingdom and France are not disposed to pay the prices which Ceylon copra commands. They seem to be satisfied with inferior grades, and import the Straits and Philippine copra at a lower cost.

The manufacture of coconut oil is an industry that has existed in the Island for considerable time. It was at first produced entirely by primitive oil mills, or chekkus, a contrivance worked by a pair of bullocks. Such mills were widespread in the middle of the last century over the whole of the Western and Southern seaborde of the Island, where the palm then flourished. Moreover, at that period the oil was the most important form of coconut produce which figured in our export trade. But these primitive oil mills have been gradually driven out by competition with modern machinery, until at present their number is greatly reduced in the Western and North-Western Provinces. They still survive in the Southern Province. The oil produced in that Province and usually exported from Galle is the produce of these mills. Colombo is the centre of the trade in the extraction of oil. There are three large establishments with modern plant in constant working. It is reported that a fourth mill is almost ready for opening. But, apart from these extensive undertakings, smaller installations for the expression of oil by modern machinery exist in several parts of the Western and North-Western Provinces, often associated with works, set up for the manufacture of desiccated coconut.

The oil exported is of two qualities or grades. The white oil of Ceylon is expressed from the best grades of copra, whilst common oil is the product from inferior copra. The bulk of the Ceylon oil is taken by the United Kingdom and America, as oil imports to Germany, France, Russia, and Austria—countries using coconut oil in the manufacture of edible fats very largely—are effectively blocked by a prohibitive duty. Such a duty is calculated to protect the home manufacturer of oil against a foreign manufactured commodity as he is permitted to import his raw material (copra) free of duty.

DESICCATED COCONUT.

This local industry is of recent origin. It was started by an enterprising firm in Colombo not more than thirty years ago. Since then the demand has gradually increased until last year 15,190 tons figured in our export trade. It is worthy of note that Ceylon practically monopolises the world's supply of this food product. At present there are dozens of mills manufacturing this article distributed throughout the chief centres of coconut cultivation. As nuts in a fresh condition are necessary for this manufacture, the centres of production must be located in the neighbourhood of plantations, owing to the cost of transport entailed by the weight and bulk of nuts in the shell. This industry is now so thoroughly established and so well understood, that it is worked very economically. The lead therefore that Ceylon has acquired in this is not likely to be lost for a considerable time.

POONAC.

The cake after the expression of the oil from copra called poonac is largely exported to Germany and Belgium. The product of the chekkus or village oil mills is consumed locally. Coconut poonac, however, is not popular in Ceylon for cattle food as the oil cake from Gingelly or Sesame seed. Gingelly poonac is imported from India and fetches a price about 60 or 70 per cent. higher than coconut poonac. In 1913 over 25,546 tons of gingelly cake were imported to the value of over two million rupees. If the mill owners of Colombo study the local market for poonac more closely, and exploit it more systematically, a considerable portion of the gingelly poonac now imported may easily be replaced by coconut poonac as cattle food in the Island itself. The coconut poonac exported to Europe amounted to 11,000 tons in 1913 which is less than half the quantity of Gingelly poonac imported for home consumption. It is evident therefore that the local demand for oil cake is large enough to use up the whole of this by-product of the oil mills.

FIBRE AND YARN.

Of the secondary products derived from the Coconut palm Fibre and Yarn obtained from the husks are exported from the Island in large quantities. The latter is almost entirely a village industry confined to the Southern Sea-borde, whilst the former is the output of several mills studded throughout the Western and North-Western Provinces. At present the demand for fibre is more than met by the local output, as several of the mills have to give up working when the demand slackens and the price is low.

A considerable amount of fibre is exported to Germany and Belgium, where it is worked up into brushes and then sent to the United Kingdom. It would seem that the manufacture of cheap brushes can only be successfully carried on with cheap labour, and a suggestion has been made to Ceylon through the Secretary of State of the advisability of setting up brush manufactories in this Island with a view to supply the British market and thus supplant the German manufacturer.

Of the exports of oil and copra from Ceylon in 1913 the distribution amongst the chief importing countries was as follows :—

		Oil.	Copra.
United Kingdom	Tons	7,500	75
Austria ...	,,	715	1,500
Belgium ...	,,	220	900
Germany ...	,,	55	40,700
Holland ...	,,	115	52
France ...	,,	—	50
Norway ...	,,	2,000	—
Sweden ...	,,	170	—
Denmark ...	,	—	1,280
U. S. America ...	,,	16,115	—
Russia ...	,,	20	11,000

Our export of coconut oil was practically confined to U. S. America, which received 60 per cent. of our output, and the United Kingdom and Norway the balance.

The entry of our oil to these countries is not barred by a protective duty. The export to the United Kingdom amounting to 7,500 tons requires further

comment. It is not due to the fact that there is no great demand for oil in the British Isles. On the contrary the trade returns in 1913 indicate that imports into United Kingdom from foreign countries amounted to the extent of 49,000 metric tons, 30,236 of which came from Germany and the balance from the continent of Europe, chiefly from France. Commenting on this, the Directors of the Imperial Institute in a recent communication to the Under Secretary of State to the Colonies states :—"There appears to be no reason therefore why the coconut oil which reaches the United Kingdom from Hamburg should reach it in this roundabout way. The oil might be expressed in Ceylon or India and shipped direct to the United Kingdom or the copra might be exported to the United Kingdom and treated there instead of in Hamburg." Further it is certain that from all these foreign countries, which export coconut oil to the United Kingdom, and especially from Germany, considerable quantities of coconut oil also reach this country in the form of margarine, vegetable butter and prepared fats and foods of various kinds. No definite figures can be suggested for the amount received in this way.

"It is clear from the foregoing that considerably more than half of the British Copra hitherto exported to Germany and Austria-Hungary could be taken by the United Kingdom either in the form of copra or coconut oil. Ceylon produces both copra and coconut oil; so that Colony could probably divert its supplies in either form to the United Kingdom."

The reason which induces the British manufacturers to use Continental coconut oil in preference to the Ceylon article cannot be due to any inferiority of this island's produce, as Ceylon oil commands high prices and the United States shows a marked preference for it. In 1913 the States imported 18,000 tons from India and Ceylon out of a total oil importation of 22,915 tons for the year. Why the British manufacturer prefers produce from the Continent whereas the American shows great partiality to the Ceylon out-put is an anomaly that requires further explanation.

COPRA.

As stated before, the export trade of this article from Ceylon is of recent growth. In 1870 it amounted to only 2,031 tons of the value of £31,678 as against an oil export of 6,782 tons valued at £170,211. The following table will show how the exports have increased, decade by decade, and the relatively greater importance which copra has assumed in the trade of the colony.

	Copra.				Oil.			
1870	2,031	tons	value	£.	31,678	6,782	tons value	£.	170,211
1880	4,638	,,	,,	Rs.	912,489	17,623	,, ,,	Rs.	4,386,414
1890	7,809	,,	,,	,,	1,480,817	18,436	,, ,,	,,	4,588,561
1900	19,990	,,	,,	,,	3,809,114	23,413	,, ,,	,,	6,672 902
1910	37,935	,,	,,	,,	12,697,725	30,984	,, ,,	,,	17,326,252
1913	55,864	,,	,,	,,	20 959,266	27,349	,, ,,	,,	13,737,710

During the last fifteen years the exports of copra have increased nearly threefold whereas the oil out-put has only increased by about a third, and last year the value of the copra exported exceeded by about a fourth the value of the oil whilst in quantity it was more than double.

The distribution of our export in 1913 amongst the chief importing countries reveals several noteworthy features. Only two countries can be said to be importing Ceylon copra on an extensive scale, viz :—Germany and Russia. Out of the total of 55,864 tons Germany received 40,700 tons, or nearly 75 per cent. of the whole, and Russia 11,000 tons, or 20 per cent.

In the same year the United Kingdom imported 30,000 tons and France 153,000 metric tons from other countries. But both these countries have abstained from using Ceylon copra and have been satisfied with the inferior article exported from Java, Singapore and the Philippines. It would be interesting to discover why it pays the German manufacturer to favour Ceylon copra while British and French merchants have no use for it at the higher price which it commands in the European markets. Since the war began the conditions have altered materially and the United Kingdom imported in 1914, 20,876 tons from Ceylon as against 75 tons in 1913.

COCO, COCOA AND COCA.

Says the CHEMIST AND DRUGGIST: "The confusion between the words coco and cocoa is of long standing. It is supposed to have arisen from the accidental running together in Johnson's "Dictionary" of the articles referring to two different vegetable products. Coco has, in consequence, been since often written cocoa. Cocoa applied to *Theobroma Cacao* is, states MURRAY, a corruption of cacao, which from the sixteenth to the eighteenth century was also written cacoa, and sometimes in the eighteenth century cocao. It is interesting also to note that originally cocoa and cacao were three-syllable words, but the error of spelling coco as cocoa has corrupted the pronunciation of cocoa to coco. The fact that another similar name—coca—is in use does not help to simplify matters."

In order clearly to distinguish between these similar sounding names we give below the botanical equivalent of each :—

Coconut	...	Cocos nucifera.
Cocoa	...	Theobroma cacao.
Coca	...	Erythroxylon coca.
Coco-yam	...	Colocasia esculenta.
Cho-cho	...	Sechium edule.

C. D.

KAPOK LIFE-SAVING JACKETS.

The collar which the Admiralty supplied to the seamen after the loss of the "Hawke" and other cruisers is doubtless useful in smooth water, but in rough seas it has the disadvantage of scarcely keeping the mouth above the level of the waves. Another garment, of which approval was expressed in THE TIMES in an article on safety appliances for airmen, is the Boddy Life-saving Jacket, several thousands of which have been recently supplied to the Admiralty for naval purposes. A waistcoat on the same principle has now been designed. These articles are stuffed with kapok, which is five times as buoyant as cork, and the waistcoat will support two people easily for 24 hours or longer. It is an extremely warm article of clothing and can be worn continually, as it allows complete freedom of movement and does not interfere with the wearer going about his ordinary work.—LONDON TIMES.

TEA.

NOTE ON THE EFFECT OF LEAVING A LIVE BRANCH ON BUSHES AT PRUNING.

The experiment was tried at the Peradeniya Experiment Station on three plots of dark-leaved Manipuri indigenous tea.

The five Manipuri plots were pruned in December, 1913, a live branch being left on all the bushes, except on two average rows in plots 148, 149 and 150.

The live branches on all the plots were plucked regularly every week from December to April, and the weight of leaf recorded. Calculated at 24·15 per cent. made tea the live branches yielded as follows :—

Plots. No.	146	147	148	149	150
Made Tea lb.	102	105	97	153	135

Allowing for the two rows in plots 148-150 on which there was no live branch, the total yield from the live branches for those plots would be

No.	148	149	150
Made Tea lb.	114	189	150

When the bushes came into bearing again in April, all the live branches were removed. The two lines on each plot which had no live branch were plucked separately, and the weight of leaf compared with that from two adjoining rows.

The total yield of green leaf obtained from these rows from April to December inclusive is shown in the following table :—

	Plot 148.	Plot 149. Dadap plot.	Plot 150. Albizzia plot.
Two rows of tea Live branch retained	585	576	569
Two rows of tea No live branch	553	515	528
Increase with branches retained	32	61	41
=	5·78 %	11·84 %	7·76 %

The actual total yield of made tea from each plot 146–150 for the whole year including the tea from the live branch was :—

	Yield from live branch, December to April. lb.	Yield from whole plot, April to December. lb.	Total yield. lb.
Plot 146	102	898	1,000
,, 147	105	860	965
,, 148	97	858	955
,, 149	153	1,078	1,232
,, 150	135	1,093	1,228

This represents an average monthly yield of 106 lb. tea per acre plot for the nine months in actual bearing, and the average yield from the live branch when the bushes were otherwise out of bearing amounts to 11 per cent. of the total crop per plot.

The practice of leaving a live branch on the bushes at pruning as adopted in the Matale and other low-country districts in Ceylon is, therefore, a sound one, provided the ját of tea is good and the estate well cultivated.

M. KELWAY BAMBER,
Government Chemist.

Peradeniya,
25th January, 1915.

TEA AT THE PERADENIYA EXPERIMENT STATION.

The return for the month of December was 4,175 lb. green leaf and for January 3,037 lb. The November made tea fetched in Colombo 49 cents per lb. for broken orange pekoe and an average of 44 cents for all grades; that for December 54 cents and an average of 48 cents. These prices leave us with a substantial profit over the old method of selling the green leaf.

The total output of green leaf for 1914 is 56,415 lb. from 15 acres (4 of which are under rubber), an average of 3,761 lb. green leaf equal to 940 lb. of made tea.

Plot 155 (Assam Hybrid) has given the highest yield, 5,257 lb. green leaf equal to 1,314 lb. made tea per acre. A bulletin will be published bringing the experiments up to date.

All supplies have been mulched with dadaps and jungle stuff and are being watered by means of a small hole being dug on one side and re-covered when the water has soaked in. By this means the water is conserved and the plants do not require water so often.

D. S. CORLETT.

PRUNING TEA.

At present this is the most noticeable cold weather work being put through. Of all seasonable works, there is not one that for a time alters the appearance of a garden more than pruning. You may pass through a whole series of gardens belonging to different districts, and on the outward face of things it would appear that there is not one iota of difference in the pruning of one garden from another. This may actually be the case, but still in the majority of instances the pruning will alter more or less. Not so much attention is now given to appearance as formerly. The system of straight-across table pruning is not practised now. Still, a well-pruned garden, whatever system is practised, is never a displeasing sight to the planter who can distinguish good pruning from bad pruning in principle. A little more wood is being left, I think, this year than formerly upon some gardens. Some, it is to be noticed, appear to be cutting lower in the centre than usual and many still adhere to the practice of leaving too much of a fringe round the outside of the bushes.

COLLAR PRUNING.

I have heard of only one instance of this in our district this season, and that on a very small scale. Collar pruning does not prove so successful in Cachar and Sylhet as is the case in the deep alluvia of Upper Assam. When collar pruning is resorted to here it is merely a last resource and is usually done with the view of rooting up all the section which does not respond to the operation and replanting with strong, healthy seedlings of a good *jat* of plant. The bushes are usually well manured, and in some instances somewhat lightly plucked the year before collar pruning is attempted. In one or two instances I have known the ground to be extra deeply hoed and the bushes well manured for two seasons before collar pruning took place. If this is done and collar pruning is done at the proper season, the plant will have a much better chance of commencing successfully through the operation than it would have if existing under less favourable conditions. Even then the operation will not be so successful as it would have been in Upper Assam, where the roots, as a rule, throughout the year are in contact with more moisture than we have here during the dry season. The plants are also in a better condition for standing the severe trial on their vitality of a collar prune by having their roots occupying a much greater volume of soil containing a practically inexhaustible amount of plant food.—INDIAN AGRICULTURIST.

DROPPING OF BREADFRUIT.

We often have callers and letters asking why the young fruit drops from certain breadfruit (or other fruit) trees, so that none mature. This is usually because there is too much vegetative vigour in the trees—they run to leaf and twig, and this condition is usually caused by a too plentiful supply of water at the wrong time.

As a rule such trees are standing in yards where there is a water pipe, and the water is constantly soaking the roots, inducing fresh growth. When once the breadfruit tree blossoms freely, the water should only be allowed moderately when the soil is seen getting dry ; and the fruit will thus hold.

Where the conditions of growth are not governed by a water pipe, and the fruit will not hold, the owner should try, as an experiment, girdling the tree with a wire drawn tight round the trunk, doing this just when the fruit is setting. It will generally be found that this will prevent the falling of the fruit. When the fruit is over half fit the wire can be taken off and the bark will heal over in three months.

This can be done with all fruit trees that drop their fruit just after setting, or when trees make plenty of leaf growth but do not fruit at all. Of course, dropping of fruit is not to be confounded with young fruits dropping because of the trees bearing too large a crop ; in this case there are always plenty left to mature. Our remarks apply when no fruits, or only a very few, remain on the tree, all the others dropping off before maturity.—JAMAICA AGRICULTURAL SOCIETY JOURNAL.

TOBACCO.

TREATMENT OF THE TOBACCO PLANT.

NICHOLAS SACHOULIS.

When the tobacco plants come to maturity and the proper number of leaves can be secured, do not wait for the bloom.

Topping is a matter of judgment, and the number of leaves left varies with each plant, and is determined by the vigour of the plants, the character of the season, and the purpose for which the crop is being grown. If too many leaves are left, they will be coarse. Err in the direction of leaving too many. Additional leaves can be removed later if necessary. Late rain and new growth often render plants coarse that otherwise were correctly topped. Leave from twelve to fourteen leaves on the plants when the soil and season are good.

PRIMING.

That is, taking off the bottom leaves. This can be done at the same time as topping is being performed. Three to four leaves should be taken off, as well as all leaves that are damaged. This gives the remaining leaves the full benefit of plant life.

SUCKERING.

Remove all suckers and sprouts as often as they appear. These should not be allowed to remain on the plants, but must be broken off as soon as they are from 2 to 4 in. long. If they are not removed they will rob the leaves of their strength, and thin, gumless, papery leaves will be the result. The plants should be gone over two or three times during the ripening season, as both the maturity of the plant and the texture of the leaf depend upon this suckering being well and faithfully done. The above is necessary in order to have the field ripen evenly, and also to get a good quality and quantity.

PREPARATION.

Have knives, sticks, poles, twine, needles, barns, and labour well in advance of the season. An important matter for the tobacco-grower is not to overcrop himself, and to know that twelve or fourteen leaves give more pounds and a better product, with less labour. Neglect in this particular means badly-handled tobacco and loss of time and money.

CAUTION.

Do not cling too closely to any particular practice. Methods must vary with the season and condition, but the methods must be based on the principles underlying the growth of the tobacco plant and the production of good tobacco. Unless you know what is required, and what any particular method will accomplish, you are working in the dark. If tobacco could be grown anywhere and everywhere, it would have no value. A business that gives so good a return cannot be left to chance. Do not be misled into thinking that you will achieve a high degree of success from the beginning, for it takes some years to adapt methods to conditions. In a future paper I will deal with harvesting and curing tobacco.—QUEENSLAND AGRICULTURAL JOURNAL

CHEMICAL CHANGES IN THE TOBACCO PLANT.

With a view to contributing to the knowledge of the tobaccos grown in Italy and of resolving certain problems of biological and technological chemistry it was considered advisable to determine the variation in chemical composition of the plant during the growth and the effects produced by the different treatments of drying and fermenting to which the green leaves are subjected during the process of manufacture. These results were obtained in researches on the variety Xanthi Yaka, grown at Francavilla al Mare (Abruzzi). Analyses were made of seedlings in the nursery, plants before flowering, ripe leaves from each picking and the bare stems and roots remaining in the field after harvest.

In this preliminary study the following determinations were made on different parts of the plant after drying in a water oven : ash, total nitrogen, nicotine, organic acids, ether extract, alcoholic extract [The last two determinations are not reproduced.—ED.]. Ordinary methods were used except in the case of nicotine, for which a slight modification of Keller's process was preferred on account of its rapidity : the nicotine was displaced by 20 per cent. potash and extracted by a mixture of equal parts of sulphuric and petroleum ether, then titrated against $\frac{N}{10}$ sulphuric acid with congo red as indicator. The organic acids were displaced by sulphuric acid 1. : 3, extracted with ether, titrated against soda, using phenol-phthalein as indicator, and expressed as oxalic acid.

The seedlings were analysed as a whole as well as in portions, and gave results as shown in Table I. :—

TABLE I.—Analyses of Seedlings.

Parts analysed.	Ash.	Total Nitrogen.	Nicotine.	Organic Acids.
Leaves	15·92	4·45	1·13	5·03
Stem	18·40	2·90	0·48	5·40
Roots	14·33	3·04	0·80	3·93
Whole plant	15·85	3·81	0·65	4·45

The analyses of the plant before flowering are given in Table II:—

TABLE II—Analyses of plants before flowering.

Parts Analysed.		Ash.	Total nitrogen.	Nicotine.	Organic acids.
Leaves from middle and lower portion of plant	whole	10·50	2·86	1·18	3·56
	blade	10·40	2·92	1·23	3·47
	ribs	10·60	2·02	0·80	4·01
Apical leaves	complete	11·10	4·30	0·89	3·36
	blade	12·45	4·70	0·91	3·45
	ribs	10·55	2·08	0·81	4·01
Stems ...	...	6·40	1·25	0·29	3·65
Roots ...	...	6·85	1·69	0·65	4·23

The leaves harvested at the 1st (basal), 2nd, 3rd and 4th (apical) periods were analysed whole and in parts (blades and ribs). The bare stems and roots remaining in the field were also analysed. The results are set out in Table III:—

TABLE III—Analyses of leaves of the various pickings.

		Ash.	Total nitrogen.	Nicotine.	Organic acids.
1st picking	whole leaves ...	16·10	1·57	1·42	4·61
	blades	16·40	1·69	1·56	4·50
	ribs	14·70	1·23	0·46	4·64
2nd picking	whole leaves ...	12·30	1·00	1·52	4·52
	blades	12·35	1·02	1·94	4·50
	ribs	12·10	0·77	0·73	4·54
3rd picking	whole leaves ...	8·55	1·26	0·75	3·75
	blades	8·25	1·35	0·84	3·52
	ribs	9·80	0·96	0·24	3·91
4th picking	whole leaves ...	7·50	1·50	0·74	4·07
	blades	7·20	1·58	0·81	3·76
	ribs	9·00	1·34	0·32	4·95
Bare stems		6·40	0·55	0·19	3·92
Roots		7·40	0·72	0·16	7·78

These results show that (1) seedlings are richer in ash, nitrogen and organic acids than half-grown or full plants. (2) In plants before flowering, the apical leaves are richer in ash, nitrogen, and substances soluble in ether and alcohol than the lower leaves, but they contain less nicotine and organic acids. (3) In ripe leaves, the ash content decreases from the basal (1st picking) to the apical leaves (4th picking), and the leaves of the 1st and 2nd pickings are also richer in nicotine, containing double the quantity of the leaves of the 3rd and 4th pickings. (4) The leaf blades are always richer in nitrogen, nicotine and substances soluble in alcohol and ether than the ribs, and generally also in ash, but they are poorer in organic acids. (5) The stems and roots contain less ash, nitrogen, substances soluble in ether and alcohol, and nicotine than other parts of the plant, but the roots contain more nicotine than the stems.—MONTHLY BULLETIN.

THE INDIAN OIL PRESSING INDUSTRY.

That the oil-seeds industry is one of the important industries of this country will be realised when it is seen that in the Bombay Presidency (inclusive of Sind) alone there are nearly 4,000,000 acres—not 400,000 as mentioned in the Government Resolution on the Reports—of these seeds under cultivation, and the value of the export trade in 1912 amounted to over 520 lakhs of Rupees. The chief seeds from which oil is extracted in the country are the cotton-seed, ground-nut, castor-oil seed, rape-seed, linseed, poppy-seed, and mowra-seed. Linseed alone is exported from India to the value of over 420 lakhs in a year, while the value of mowra-seed exports reaches 240 lakhs, castor oil-seed 123 lakhs, rape-seed 92 lakhs, ground-nuts 92 lakhs and cotton-seed 73 lakhs. The importance of the oil-seed industry to the country is thus apparent. But, as every one knows, instead of these seeds being pressed in this country and the oil exported to Western countries, India has been exporting the raw material in large quantities, allowing the oil to be pressed and refined outside the country, thus losing a source of immense profit. The Bombay Presidency imported vegetable oils to the value of nearly six lakhs of Rupees in 1912-13—oils which, if the necessary facilities had been forthcoming, could have been manufactured locally. The indigenous oil-pressing industry in this Presidency is an old one, as everywhere else in India, and though the methods may be crude, it plays an important part in the economy of the country. MR. PANDIT calculates the total daily out-put of the *ghanis*—the indigenous oil-pressing machinery—at 155 tons. He also thinks that the *teli*—the native oil man—will be able to hold his own for a long time to come, in spite of the introduction of power machinery from the West. MR. PANDIT, however, says that the economic condition of the workers is generally far from satisfactory, chiefly on account of the high prices ruling in the land.—INDIAN AGRICULTURIST.

FIBRES.

QUEENSLAND COTTON GROWING INDUSTRY.

A. J. BOYD.

The average yield of seed cotton is about 1,000 lb. per acre, of which from 300 lb. to 400 lb. will be clean lint and the balance seed. As soon as the bolls begin to open they should be allowed to fully expose the cotton, which should be full and dry before being picked, but as soon as it has fully burst out, it should be picked at once, otherwise it will become somewhat discoloured by exposure to sun and dew, to the detriment of future prices. The picking of cotton is a far less laborious work than the picking of strawberries or Cape gooseberries. The picker has scarcely got to stoop, if the plants have been properly grown With a full crop, a boy or girl will pick from 70 lb. to 100 lb. of cotton a day, the larger quantity as he or she becomes more expert in the work. Experienced pickers can pick with both hands. Under favourable circumstances men have picked 150 lb. and even 200 lb. in a day. Picking should not be begun until the dew has completely dried off the bolls, so that when we speak about a day's work it means from about 9 or 10 o'clock in the morning till 5 o'clock in the afternoon, with the usual interval of an hour for dinner. When the crop is in full swing, i.e., when the trees are loaded with fully-burst bolls from which the whole of the cotton comes away easily at a light pull of two fingers and the thumb, a family consisting of father, mother, and four sons or daughters will easily pick 600 lb. per day, and, indeed, much more, but I prefer to give the lower figure. Supposing the farmer to have planted 10 acres, he will have 10,000 lb. to pick. I will suppose that only 500 lb. are picked daily ; then, theoretically, the whole crop is gathered by the family in twenty days.

Wet days and other necessary work upon the farm must, however, be taken into consideration, so that practically a longer time would be required especially as, at the beginning of the season, only a few bolls on each plant would be ready for picking. Given, however, a month, or six weeks even, to gather in the whole crop, it will be seen that 10 acres of cotton can easily be managed by one small family, besides paying attention to other small crops.

Where hired labour is required, it is customary to pay the pickers by the lb. The usual price paid at a time when cotton was bringing from 9*d.* to 1*s.* 6*d.* per lb. in the home markets, and the farmers were paid from 2*d.* to 3*d.* per lb. for their seed cotton, was ½*d.* per lb. (the same price as is paid at the present time) and at this price boys and girls were able to earn from 2*s.* 6*d.* to 4*s.* per day, and men and women as much as from 5*s.* to 7*s.* per day. To enable the young people to earn money at cotton-picking, it was found necessary either to alter the holidays or to allow the children to attend school for half a day only before noon, giving them their holidays during the cotton-picking season instead of at the usual period of mid-summer or mid-winter. By this plan they lost very little school time, but brought a substantial addition to the family income.

COST OF PRODUCING AN ACRE OF COTTON IN QUEENSLAND.

How much can a farmer realise from 10 acres of cotton by selling his crop at 2*d*. per lb. ?

Cost of Producing an Acre of Cotton.

	£.	s.	d.
Ploughing	0	7	0
Harrowing	0	1	0
Seed	0	5	0
Planting Seed	0	1	2
Cultivating	0	4	0
Bale	0	2	6
Marketing	0	4	0
£	1	4	8
Picking 1,000 lb. at ½*d*. per lb.	2	1	8
£	3	6	4

Mr. Jones, the Queensland cotton expert, whom I have already quoted, differs very slightly from my estimate, as the following figures show :—

A 1,000 lb. crop can be produced and gathered for about £3 16*s*. per acre, which includes cost of tillage and picking. Calculating 1½*d*. per lb. as the value of the fibre in seed, we have £6 5*s*. as the value of an acre of cotton. Considering that much higher yields are possible, the modest estimate given here is satisfactory by comparison with other crops, particularly as the estimated cost allowed for tillage is computed on a scale which most growers will deem a generous one. Some seasons have provided numerous instances where returns from £9 to over £12 per acre have been realised in the West Moreton and Maranoa districts.

I estimate as follows the return of an acre of Uplands cotton yielding an average of 1,000 lb. of seed cotton per acre :—

	£	s.	d.
1,000 lb. at 2*d*. per lb.	8	6	8
Cost of production from sowing to market (including hired labour for picking at 1½*d*. per lb.	3	6	4
Balance to credit ... £	5	0	4

On the basis of this calculation, 10 acres would bring in a net return, clear of all expenses, of £50 3*s*. 4*d*. The bale, being only a first charge, should not be reckoned in the expenses, as it will serve for several seasons if properly cared for.

If the farmer keeps the cost of picking in his own family, he saves a cash outlay of £2 1*s*. 8*d*. per acre, or, on the 10 acres, £20 16*s*. 8*d*., so that his actual net cash return amounts to £71, or £7 2*s*. per acre. How does this compare with maize growing ? A 40 bushel crop, at 2*s*. 3*d*. per bushel, gives a net profit of £2 18*s* 4*d*. per acre. The price of maize, however, fluctuates, considerably, and it often sells at 4*s*. to 4*s*. 6*d*. per bushel. Of

all our ordinary farm crops, rice is the only one which can compete in value with cotton. An acre of rice, producing 30 bushels, is worth £6 for grain and the same for straw. It costs £3 3*s.* 9*d.* to produce an acre of rice, the net profit being £8 16*s.* 3*d.* The net profit on wheat, on the same basis, and including straw, is £2 16*s.* 1*d.*, when wheat is selling at 3*s.* per bushel. On barley it is £3 1*s.* 1*d.*, and on maize, with a 30 bushel crop, £2 2*s.* 11*d.* And over all these, cotton presents the additional advantage of less labour in harvesting.

Can the Queensland farmer afford to sell his seed cotton at 1½*d.* per lb.?

Undoubtedly, a 1,000 lb. crop at 1½*d.* would pay him better than the above-mentioned crops. Picking being confined to his own family, his expenses are only £1 4*s.* 8*d.* per acre, and his return £6 5*s.*, leaving a credit balance of £5 0*s.* 4d. It may happen that the grower decided on having his cotton ginned. In this case he will pay £1 0*s.* 10*d.* per 1,000 lb. for ginning at ¼*d.* per lb., but he gets back the seed as well as the lint; 600 lb. of seed at £4 10*s.* per ton is worth £1 4*s.* 1*d.*, or 3*s.* 3*d.* more than the cost of ginning. In the United States, the ginning establishments will clean the farmer's cotton, taking the seed in payment. How does ginning affect the returns per acre?

	£	*s.*	*d.*
Expenses, including picking ...	3	6	4
Ginning	1	0	10
£	4	7	2
400 lb. lint at 6*d.* per lb.	10	0	0
600 lb. seed at £4 10*s.* per ton ...	1	4	1
£	11	4	1

In this case the net profit is £6 16*s.* 11*d.* as against £5 0*s.* 3*d.* if the cotton is sold in the seed, a difference in the farmer's favour of £1 16*s.* 7*d.* per acre. It should be noted, however, that the very best only of Uplands cotton will produce 400 lb. of clean lint from a 1,000 lb. crop. To insure this result the staple must be of good length, the seeds small, few and easily detachable from the lint, the bolls all well filled, and the crop a full one. Under ordinary circumstances the grower may reckon on 300 lb. of lint per 1,000 lb. of seed cotton, and 700 lb. of seed worth £1 8*s.* 1½*d.*, totalling £8 18*s.* 1½*d.*, against which his expenses are £4 7*s.* 2*d.*, leaving a credit balance of £4 10*s.* 11½*d.*, or 9*s.* 4½*d.* less per acre than if he had sold it in the seed.—HANDBOOK OF THE 1914 RUBBER EXHIBITION.

MANILA HEMP.

A. WIGGLESWORTH.

Manila hemp is used largely for rope-making. Its superior strength and lightness commend it beyond other fibres for this purpose, and its immunity from serious deterioration in sea-water renders it especially adapted for marine work. Certain medium grades enter largely into the manufacture of

binder twine. On late years finer grades have come much into use for braid for making ladies' hats, and these are prepared by knotting into hanks. Only the very finest fibre can be used for this purpose, and the consumption has so increased that there has been a scarcity on the fibre markets and a consequent considerable enhancement of the value of these superior marks, proportionately to the grades below current.

Manila attracts more attention and is more widely quoted in the produce columns of the Press than any other fibre, with, perhaps, the exception of Jute. This may be due to the fact that, for many years, it largely entered the field of speculative articles. When, however, the United States of America took over the Philippine Islands from Spain in 1898, and the Government of Washington granted a rebate of the export duty payable in Manila (repealed in 1913), thus encouraging the consumers in U. S. A. to import direct what previously came *via* London, this stroke of policy at once diverted from London to New York an annual turnover of 40,000 tons of fibre, and has diminished the speculation.

Attempts have been made, from time to time, to produce Manila hemp (locally called *Abaca*; botanically, *Musa textilis*) in other countries–Andaman Islands, Java, Arrakan Hills, Solomon Islands, etc.,—and although a fibre is produced to all appearances equal to medium grade of Manila, it is always of variable strength. It may, therefore, be said that the production of Manila hemp is a monopoly of the Philippine Islands, where moist air, heavy rainfall, hilly ground, rich volcanic soil, and high, even temperature all contribute the best conditions to the growth of this valuable fibre.

Though the area of the Islands covers 115,026 square miles, not far short of the area of the British Isles (121,483 square miles), only about 2 per cent. of this is planted in fibre. The tendency lately has, however, been to extend the cultivation to other islands in the group and to new districts.

As far as methods of production are concerned, it cannot be said that this is a progressive industry. While other tropical countries are forging rapidly ahead, adopting modern methods of agriculture, introducing efficient machinery, standardizing qualities and, as in the case of New Zealand, introducing Government grading, producers in the Philippines are content to continue on old-fashioned lines, and are slowly but surely being out-distanced by competitive fibres.

The following is a brief account of the cultivation of Manila hemp, for which I am largely indebted to MR. M. M. SALEEBY's papers on Fibre.

The ground is mostly prepared by hand tools, such as the hoe, Bolo (cutlass), etc., tree stumps in many areas interfering with the plough and cultivator. It is dug eight or nine inches deep—thereafter suckers about three feet high are planted eight to nine feet apart (about 600 plants per acre). It is important to keep down weeds, and twice a year the ground is gone over with hoes. Camote (*Ipomoea batatas*) is generally planted as a cover crop with the young Manila, and though retarding the growth of the crop, it shades the ground and yields a useful food product.

After the third year the plant is ready for stripping, and it lives for twelve to twenty or more years, depending on the suitability and fertility of the soil and the amount of care and cultivation given to it. Poor plantations produce about three cwt. of fibre per acre, but a plantation of normal age and growth should produce eight cwt. per acre per annum.

The fibre is extracted from the overlapping leaf-sheaths, and the average production is about 1·8 per cent. There are five or six distinct grades of fibre in each plant. The outside sheaths produce a coarser fibre of darker tint, while those near the core furnish a fine soft fibre of light colour. The five sets of distinct sheaths may produce the following grades where the plant is carefully and uniformly decorticated :—

	Per cent.
Low Grades (Fair Brown to Super Seconds) ...	5
Current Grades (Fair Current to Midway) ...	10
Good Current (From 75 per cent. over F. C. to 25 per cent. over G. C.)	25
Good Grades (From 50 per cent to 150 per cent. over Good Current)	35
Best Grade (From 150 per cent. to 300 per cent. over Good Current)	25

but in actual practice the output of inferior fibre far exceeds this, as can be seen by the following table of exports for 1912 :—

	Per cent.
Low Grades	32
Current Grades	40
Good Current Grades	18
Best and Good Grades	10

Many attempts to construct a mechanical decorticator have been made, but, so far, the hemp is mostly prepared for market by a primitive scraper, each strip being taken by hand and drawn between a blunt knife and a smooth board attached to a light frame. The fibre is then dried in the sun and packed in bales of about 270 lb. weight. There is no doubt that the satisfactory preparation and packing of this important crop can only be accomplished by the invention and application of a good decorticator, and the adoption of standard grades.

The average price of Fair Current Manila hemp during the last ten years is £30 per ton, C. i. f. London.—1914 RUBBER EXHIBITION HANDBOOK.

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PADDY CULTIVATION.

DR. COLEMAN, Director of Agriculture, Mysore State, says that among things which have been tested and shown to be advantageous in connection with paddy cultivation are (1) the use of a green manure such as Sunn hemp or cow pea, (2) the use of bone-meal as a fertiliser, (3) transplanting with one to three seedlings instead of large numbers, (4) the unprofitableness of many artificial manures, e.g. Saltpetre, (5) the usefulness of selecting seed by immersion in a weak solution of salt and water and discarding all floating seed, (6) the advisability of not ploughing the land a long time before the following paddy crop.

SOILS AND MANURES.

UNEXHAUSTED VALUE OF ARTIFICIAL MANURES.

The question of the residual value of artificial manures is complicated by the fact that arable and grass lands have to be considered separately, and that great variations are met with in different classes of land, with the result that they respond differently to different manures. From such data as are available, however, MESSRS. HALL AND VOELCKER give the following table as some sort of guide to the residues left after each crop (given as fractions of the original cost of the manures):—

Manure.	Arable Land.					Grass Land.						
	After 1st Crop	After 2nd Crop	After 3rd Crop	After 4th Crop	After 5th Crop	After 1st year	After 2nd year	After 3rd year	After 4th year	After 5th year	After 6th year	After 7th year
Superphosphate	$\frac{2}{3}$	$\frac{1}{3}$	$\frac{1}{9}$	—	—	$\frac{2}{3}$	$\frac{1}{3}$	$\frac{1}{9}$	—	—	—	—
Bones (raw & steamed) ...	$\frac{2}{3}$	$\frac{1}{3}$	$\frac{1}{9}$	—	—	$\frac{2}{3}$	$\frac{1}{2}$	$\frac{1}{3}$	$\frac{1}{6}$	—	—	—
Dissolved Bones	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{12}$	—	—	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{12}$	—	—	—	—
Basic Slag	$\frac{2}{3}$	$\frac{1}{3}$	$\frac{1}{6}$	—	—	$\frac{7}{8}$	$\frac{3}{4}$	$\frac{5}{8}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{1}{4}$	$\frac{1}{8}$
Bone Manures	$\frac{2}{5}$	$\frac{1}{5}$	—	—	—	$\frac{2}{5}$	$\frac{1}{5}$	—	—	—	—	—
Compound Manures not containing bone ..	$\frac{1}{3}$	$\frac{1}{6}$	—	—	—	$\frac{1}{3}$	$\frac{1}{6}$	—	—	—	—	—
Peruvian Guano	$\frac{1}{3}$	$\frac{1}{6}$	—	—	—	$\frac{1}{3}$	$\frac{1}{6}$	—	—	—	—	—
Fish Guano	$\frac{1}{3}$	$\frac{1}{6}$	—	—	—	$\frac{1}{3}$	$\frac{1}{6}$	—	—	—	—	—
Meat Meal	$\frac{1}{3}$	$\frac{1}{6}$	—	—	—	$\frac{1}{3}$	$\frac{1}{6}$	—	—	—	—	—
Shoddy and Wool Waste, Fur Waste, Hair, Hoofs and Horns, Greaves, &c. ...	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	—	—	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{1}{8}$	—	—	—	—
Manure Cakes	$\frac{1}{5}$	$\frac{1}{10}$	—	—	—	$\frac{1}{5}$	$\frac{1}{10}$	—	—	—	—	—
Dried Blood, Sulphate of Ammonia, Nitrate of Soda, Nitrate of Lime, Cyanamide.			—	—	—			—	—	—	—	
Kainit and Potash Salts ..	$\frac{1}{2}$	$\frac{1}{4}$	—	—	—	$\frac{1}{2}$	$\frac{1}{4}$	—	—	—	—	—

The table is based on the assumption that the manure in question is suitable for the land; further, the table can only be interpreted with considerable latitude, depending upon such varying factors as the nature of the soil, the course of cropping pursued, the climatic conditions, etc.—BOARD OF AGRICULTURE JOURNAL.

THE MANURE HEAP.

A gardener has no need to be a chemist in order to realise that remarkable and far-reaching changes occur in farmyard manure during its storage in heaps. He knows, moreover, that many of these changes are useful—that is, they increase the value of the manure—and he may infer from the state of a heap which has been left unused for a very long time that other changes are of a kind which reduce the manurial value of the heap.

Garden practice shows, moreover, that the series of chemical changes summed up in the word "fermentation" may be controlled to some extent by manipulation. For example, the "fire" may be taken out of the heap by constant turning, and so letting in air to facilitate oxidation. Thus in preparing a Mushroom bed the manure is kept loose and turned frequently, with the result that the fermentation processes are increased and the temperature rises. Presently, however, when the bed has been made firm the temperature inside it begins to fall and the bed is ready for spawning.

One reason why manure from a spent Mushroom bed, or manure which by turning has had the "fire" taken out of it, is recommended so frequently for certain garden purposes resides in the fact that it is free from an excess of ammonia, which, if present, might do considerable damage to the roots of plants. But this loss of ammonia is, from another point of view, a very serious matter to farmer or gardener. How considerable may be the loss from manure heaps of ammonia and other nitrogen compounds has been demonstrated again and again. In the most recent experiments by RUSSEL and RICHARDS the loss of nitrogen during storage was found to be from 25 to 33 per cent.

The nitrogen lost in this way means, of course, a considerable reduction in value—for in the commerce of the garden nitrogen is money. One mode by which the heap sustains this loss of nitrogen is as follows:—Urea, one of the nitrogenous constituents derived from the liquid excreta of the farm animals which made the manure, is converted by one, and possibly more than one, specific micro-organism into ammonium carbonate—a substance which readily liberates its ammonia to the air. RUSSEL and RICHARDS, in their work just cited, indicate another method whereby loss of nitrogen is sustained. These observers state that a formation of nitrates goes on on the outside of the heap; but these nitrates if washed into the body of the heap undergo a sort of denitrifying process, as a result of which nitrogen is formed and escapes into the air.

Many attempts have been made to prevent the loss of ammonia by the addition of fixers; that is, substances which interact with the volatile ammonium carbonate to form a more stable compound. Gypsum, calcium sulphate, kainit (potassium and magnesium chloride), superphosphate (acid calcium phosphate) have all been tried, though without much success. Gardening books in particular often insist that gypsum is efficacious, but as a matter of fact for it to do its work effectively about one cwt. of gypsum would be required for every ton of farmyard manure; and further more the use of gypsum is open to the objection that some of it, as MR. HALL points out in his valuable work on Fertilisers and Manures, may become reduced to the form of calcium sulphide, a substance injurious to plants.

A practice which does result in a reduction of the loss of nitrogen from the manure heap consists in using a layer of old and well-rotted manure as the basis for a new heap, and this simple and effective device should be followed by all gardeners who have to make manure heaps.

From what has been written it follows that the absence of that wasteful dark brown liquid from the foot of the heap is no guarantee that loss of nitrogen is not occurring; for the nitrates washed from the surface into the depth of the heap may, and certainly will, undergo decomposition, and thus give rise to nitrogen, which escapes into the air.

This loss may be reduced if the heap be made thoroughly firm, and if it be possible whilst making it firm to protect the manure heap from rain, the escape of nitrogen from it may be checked almost entirely.

There is room for further experiment as to the best means of protecting the manure heap from rain—a protection which, as we have shown, is of the greatest importance. Possibly, a thin layer of peat moss litter with a covering of earth might serve the purpose; or in the garden a layer of leaves covered with earth; but in any case if the nitrogen is not to be lost some protection must be given, and the heap must be made as compact as possible.—GARDENERS' CHRONICLE.

GREEN MANURES.

M. KELWAY BAMBER.

Note on two plants growing freely on the white Cinnamon Soil in the Negombo District.

The plants were collected on MUDALIYAR A. E. RAJAPAKSE's Coconut Experiment Plots in July, 1914.

1.	Sesamum indicum.	Pedalineæ.	Waltala.	Sinh.
2.	Wrightia zeylanica		Idda	,,

The growth of the Sesamum or Gingelly was exceptionally vigorous, and although not belonging to the leguminosæ the plant would be a very useful green manure for such poor sandy soils. One average plant weighed 2,300 grams, rather over 5 lb., so that a uniform crop over one acre would amount to many tons of fresh organic matter.

The physical composition of the plant was :—

Leaves and small twigs	1,205 grams	52·4 per cent.
Pithy stalks	176 ,,	38·1 ,, ,,
Roots	271 ,,	9·5 ,, ,,
	2,300 grams.	100·0

The slightly withered plant contained 69·2 per cent. of moisture, and when sun dried gave 3·55 per cent. of ash, and 0·73 per cent. of Nitrogen.

COMPOSITION OF ASH.

Lime	10·50	per cent.
Magnesia	20·16	,, ,,
Potash	27·06	,, ,,
Phosphoric acid	3·52	,, ,,
Chlorine	16·97	,, ,,
Silica	11·70	,, ,,
Carbon dioxide and difference	10·09	,, ,,
	100·00	

The ash is very rich in potash and magnesia, and contains an unusually large proportion of silica and chlorine. The property of decomposing insoluble silicates is very marked, and in this type of soil, containing 96 per cent. of silica, it should be particularly beneficial.

The proportion of nitrogen, 0·70 per cent., in the sun dried plant is low and not equal to the leguminous plants, but the free growth and large amount of organic matter it yields per acre would make up for this deficiency.

Wrightia zeylanica is a shrubby plant bearing many white flowers. It is too woody for green manuring purposes.

The proportions of the plant are

LEAVES AND FLOWERS.	WOODY STALKS.	ROOTS.
77·00	76·00	80·00

or with a ratio on the sun dried plant of 69·0 per cent. of leaves and stalk and 31·0 per cent. of roots.

The sun dried plant contains 1·47 per cent. of nitrogen and 4·65 per cent. ash.

COMPOSITION OF ASH.

Lime	19·25	per cent.
Magnesia	15·21	,, ,,
Potash	23·93	,, ,,
Phosphoric acid	6·24	,, ,,
Silica	12·50	,, ,,
Sulphuric acid	2·40	,, ,,
Sand	2·60	,, ,,
Chlorine	11·67	,, ,,
Carbon dioxide and difference	6·20	,, ,,
	100·00	

INJURIOUS EFFECT OF SOME MINERAL SALTS.

One of the most paradoxical of the recent discoveries in plant physiology is that those mineral substances which are known to be essential to the nutrition of plants may also exercise a poisonous effect.

The classical example of this fact was discovered long ago by Loew who showed that although magnesium is an essential plant food, yet in the absence of calcium even moderate supplies of magnesium salts are toxic to plants ; or to put the matter in another way, magnesium is at once a food and a poison, and calcium is an antidote to that poison. Similarly, it has been shown that the ubiquitous sodium compounds may act as plant poisons, but that calcium again acts as an antidote. These experiments were extended by Osterhout, who, working with marine plants, demonstrated that each of the salts of sea water is poisonous when it alone is present, but that in the natural mixture of salts in sea water the several toxic of the individual salts cancel out, and make of sea water a physiologically-balanced nutritive solution for marine plants. Similar facts are known to obtain with respect to animal nutrition, and it may be that therein lie the remarkable therapeutical effects which follow in certain cases from injection of sea water into the blood-system of human beings. The interesting theme of the toxicity and anti-toxic effects of mineral salts has been investigated recently by Mr. M. McCoot, who has extended his inquiry to include salts of calcium, potassium, sodium, ammonium, magnesium, strontium, and barium. Besides finding that calcium antidotes each of these poisonous substances, Mr. McCoot also discovered that they may be arranged in mutually antagonistic pairs. Thus antagonism, and hence neutralisation, of poisonous individual effects occur between magnesium and strontium, sodium and potassium, and so on,

The facts are not without bearings on practice. For example, it is claimed by some experimenters that the use of kainit—a mixture of potassium sulphate, magnesium sulphate, and magnesium chloride—produces a larger yield when it is applied in autumn than when it is applied in spring ; the difference being, perhaps, due to the washing out from the soil by winter rains of the injurious magnesium salts.

The most striking conclusion, however, is that calcium is the most general antidote, for it supplies an explanation of the high value which attaches to the use of lime in the field and garden. Gardeners and farmers discovered long ago the value of lime. Men of science have been labouring after practice and suggesting one reason after another to account for the beneficent action of lime. In the meantime gardeners and farmers have to some extent neglected to continue the old practice of marling. The moral is clear that, whatever be the source or sources of the virtue which resides in lime, the gardener must go on with, and extend, the practice of liming his land.—

Gardeners' Chronicle.

ARTIFICIAL MANURES FOR TOMATOES.

The conclusion reached in Bulletin 142 of the West Virginia University (Agric. Exp. Station) is that the best artificial manure for outdoor tomatoes is one containing 3 per cent. nitrogen, 8 per cent. available phosphoric acid, and 10 per cent. potash. The manure, which should be applied at the rate of 400 lb. to the acre, may be composed of 75 lb. nitrate of soda, 200 lb. of 16 per cent. acid phosphate and 80 lb. of muriate of potash ; or 75 lb. of nitrate of soda, 150 lb steamed bone meal and 80 lb. of muriate of potash The crop requires also stable manure or other humus-yielding material.—

Gardeners' Chronicle.

DAIRYING.

THE INFLUENCE OF FOOT-AND-MOUTH DISEASE ON THE COMPOSITION OF MILK.

F. BORDAS AND S. DE RACZKOVSKI.

After giving a resumé of the question which has interested the chemists and magistrates appointed for the suppression of frauds, the writers furnish additional information for the solution of this problem. The researches were made with samples of milk taken with all possible care in the presence of the local veterinary surgeon in places where foot-and-mouth disease had been reported. The results of the analyses of diseased and healthy milk from the same cowsheds have been compared with the average obtained the same day from milk collected throughout the district.

The changes in the composition of the milk and butter due to this disease are as follows:—

MILK.

A notable increase in the proportions of fat and mineral salts, especially chlorides, and a decrease in the percentage of casein. There is apparently no change in the percentage of lactose, except that in the case of milks from cows in the height of fever and of those with abnormally high fat content there is a decrease in lactose accompanied by a corresponding increase in ash. The percentage of organic phosphorus and the acidity remain unchanged. Milks in which solids-not-fat fall below 86 gms. per litre are rare.

BUTTER.

Examination of butter from a single badly-diseased cow might lead one to suspect addition of about 25 per cent. of margarine, whilst that from a herd of cows more or less infected would be suspected of an addition of 5 to 6 per cent. The conclusions of the writers confirm those put forward by French Analysts.

Thus, though it is true that the milk from a single cow or a small number of cows in the same shed, or that the butter obtained from a small quantity of infected milk show an abnormal composition, the collected milk or the butter centrifugalised from it never show any defects such as would make them unsaleable.—MONTHLY BULLETIN.

THE FEEDING OF DAIRY COWS.

Although no definite conclusions can be drawn from the results of a single experiment, the following summary may prove of use to those who have not time to peruse the full report. It should be distinctly understood, however, that the statements here recorded are such as were obtained under

the conditions of this experiment only:—

1. The cows fed on Decorticated Cotton Cake yielded more milk than those fed on Palm Nut Cake (equal money value).

2. Although no difficulty was experienced in getting the cows to eat 7½ lb. of Palm Nut Cake per day, providing it was introduced gradually, it was noticed that both lots of cows ate the Decorticated Cotton Cake with greater relish.

3. Both lots of cows dropped in milk yield in every case when changed to Palm Nut Cake; when changed to Decorticated Cotton Cake (first consignment) there was a slight increase both times, while with the two changes to Decorticated Cotton Cake (second consignment) there was a fall in yield.

4. The milk from the cows fed on Decorticated Cotton Cake was slightly richer in fat and in solids-not-fat, but, speaking broadly, the foods had no marked effect on the composition of the milk.

5. The cows comprising Lot B gave more milk than those in Lot A, and their milk was richer in fat and solids-not-fat than that from Lot A.

6. The Palm Nut Cake, though fed in fairly large quantities, had no undesirable effects on the butter produced.

7. Palm Nut Cake is a perfectly safe food for milk cows, and might give better results if fed as a part of the cake portion of the ration (2-3 lb.) than were obtained in this experiment where one cake only was introduced.

8. Judging from the results of this experiment, it would appear that unless there is a greater difference between the price of the two cakes than existed when the cakes used in this experiment were purchased, Palm Nut Cake, though it can be recommended as a safe food for milk cows, possesses no economic advantage over Decorticated Cotton Cake.—FARMERS' BULLETIN, No. 28.

COFFEE AT PERADENIYA.

Half a bushel of parchment hybrid coffee has been sent to the Imperial Institute for report as to flavour and commercial value.

The young Robusta plants planted out under the established shade of L. glauca and in the place of Liberian coffee heavily infected with Scale (*Cocos viridis*) and *Hemileia* show no sign of being affected by the latter.

But the young plants planted out without shade next the Robusta plot still continue to be attacked by both Scale and Hemileia in spite of continual spraying with both kerosene and Bordeaux mixtures.

D. S. CORLETT,
Manager,
Peradeniya Experiment Station.

APICULTURE.

BEE KEEPING IN CEYLON.

A. P. GOONATILLEKE.

Transferring is the term used for taking the combs and bees from one hive into another, it may be from a log or some natural or artificial hive into a modern frame hive. The easiest way to do this is to drive the bees, cut the combs, fix them in frames as quickly as possible, place them in the hive, shake the bees into it, and close the hive. If the natural hive is so situated as to make it impossible to drive the bees, smoke them till they are thoroughly frightened and split open the hive, when the combs may be easily removed and the bees put in. Care should be taken not to injure the brood in cutting out combs. If the combs so removed are larger than the frame, cut out the empty parts of the comb and put it in the frame tight fit or if the combs are smaller than the frame tie them on to the top bar of the frame with tape. Transferring should be done on a hot day and take as little time as possible to complete the operation. If there is brood in the combs and if a longer time is taken, the brood may be chilled which is harmful. The bees should not be disturbed at least for four or five days after transferring, or they may abscond. A beginner should attempt this by seeing how it is really done.

Driving is making the bees leave their combs and cluster elsewhere or run into a box or hive. This operation can easily be done if the hive has two entrances or openings. When the bees are smoked from the opening below they will leave the combs and run out from the one above. If a chatty, box or hive is placed over the top opening but touching the edge of it bees can be driven into it by smoking them from below. But if the bees are in a pot, box or some such thin vessel driving could be done by rapping on the sides of it. If for transferring, the bees may be driven into a small packing case. Transfer the combs and shake the bees on them. If the hive is in an anthill, rockcave or the hollow of a tree with one opening, driving is extremely difficult, if not impossible.

ABSCONDING SWARMS.

Absconding means the bees quitting the hive soon after it is colonised or long after they have settled down. Nothing is more annoying than this to the beekeeper, for they may without due warning quit the hive for the forest or some unknown parts without showing us the least gratitude for what we have done in providing them with a comfortable home, etc. This is due to accidents, unskilful handling, enemies, want of food, bad hive and various other reasons. Absconding may be prevented by clipping the queen.

INTRODUCING.

As a rule only one queen is tolerated in a colony of bees. During the swarming season there may be two or more new born queens in a hive, but if ever they meet there will be a royal battle till one only remains alive. But if an old queen is to be superseded the daughter may be allowed in the hive with the mother, and after a very short time the latter will disappear.

A queenless colony will not accept a strange queen unless she is introduced into it by artificial means, nor can we introduce one to a colony that has a queen, for the queens are jealous rivals. To introduce a strange queen to a colony remove the one in it, put the one to be introduced in a wire-cloth cage with sufficient food for her for three or four days and place it between the combs. The introducing cage must be so made that bees will not enter it. The new queen may be released after she has acquired the odour of the bees in that colony. It is said that bees recognise their queen by scent, which seems to be more keen in the bee than in any living being. A virgin queen (soon after its birth) can be introduced to a queenless colony without the cage, provided it is not too long queenless. Such a queen is readily accepted by bees without any harm being done to her. Another (safest) method of introducing without the cage is to remove the queenless hive into a new stand and place another hive with one or two combs with bees in them from the queenless hive in it on the old stand from which the queenless colony is removed. The field bees will all return to the new hive on the old stand by next day leaving only the young bees in the hive to which the queen is to be introduced. The queen may now be allowed to run in amongst the young bees and they will accept the strange queen without harassing her. There are so many ways of making and introducing cages, but the one made of wire cloth to be fixed by pressing against the comb is the cheapest and easiest, for it can be fixed (with the queen inside) on to a part of the comb where there is honey.

Uniting is to put together two or more swarms; this is usually done if the colonies are very weak, but if one desires to have an extra strong colony two or more normal colonies may be united. This may be done by feeding the colonies to be united with perfumed syrup and sprinkling same on the bees and frightening them with smoke; if two colonies are to be united the queen in one should be caged and the queen in the other removed altogether. Uniting is essential to keep the stocks strong just before a honey flow which means a larger yield of honey. Only queenless colonies or colonies with unfertile queens may be united to one that has a queen. To avoid the accident of bees so united going back to their old hive, the hive in the colony to be united should be removed by degrees to the same stand on which the other hive is placed and place it side by side with it taking care to keep the entrances facing the same way and remove the empty hive soon after they are united. Uniting during the swarming season is extremely easy, because the swarms (excepting the prime swarm) issued from the same hive could be united without feeding or the aid of smoke, for the cast swarms are issued about a week after the prime one and usually more than one a day. Being from the same hive and having the same odour they settle down together amicably.

FRUIT.

DIE-BACK OF CITRUS TREES.

This is a very common trouble with us and the gradual dying down of trees with which there is apparently nothing radically wrong is a most disappointing experience in orange growing.

Mr. G. Williams, writing to the Queensland Agricultural Journal, thus discusses the predisposing causes of the malady:—

Primarily, soil of a heavy nature; a close, retentive, or impervious subsoil, giving rise to the effect of extremes of dry and moist conditions (an undue percentage of "clay" exercises similar influence) with insufficient drainage, lack of cultivation, overmanuring, excessive irrigation, and also working on unsuitable stock. Drainage is a most important feature, citrus being very deep rooted ; and no artificial system is applicable to remedy a natural deficiency. In its absence an even state of moisture cannot be maintained. Where different classes of soil, particularly those of a widely different nature, are included in one orchard, and it is noted that trees planted in one class are healthy and vigorous whilst in another they are badly attacked, the suggestion arises that to the unsuitability of such soil is almost, if not entirely, attributable the cause of the trouble. Wider observations and comparisons afford the fullest confirmation. Trees planted in light loam of good depth remain immune, and, even when cultivation is neglected, show but very slight indication of attack; but where a dense constituency prevails some of the known features favourable to the disease are an invariable accompaniment. Its presence is eventually manifested in a varying extent—even to killing the trees outright. In consideration of suitable soils, examination must go much below the surface. On alluvial flats with a surface of loose sandy soil, a subsoil of heavy nature is not infrequently met with, and in such situations trees flourish but for a limited time. The trees being evergreen and almost constantly active, sustaining uninterrupted evaporation from their leaf surfaces, must always be provided with moisture, or disease will result to tree or fruit. Without excessive rainfall, the requisite supply of moisture can be retained in a suitable soil by cultivation; but where an unbroken surface, or grass or other weeds are permitted, a corresponding depression exists. The theory of maintaining moisture by surface cultivation has been frequently explained. Exact determination of moisture present during a dry month, at depths of the soil from 1 ft. to 6 ft., shows a gain of almost 50 per cent. where cultivation prevails. Moreover, in cultivated land the water in lower soil is held for the use of roots, and as fast as absorbed by them the supply is replaced through the firm soil below, which, evaporation being stopped, remains moist and permeable by the roots.

ENTOMOLOGY.

SOME SOUTH INDIAN INSECTS.

T. BAINBRIGGE FLETCHER.

Those interested in Economic Entomology in India have recently been provided with two valuable text books. There is "Indian Forest Insects" by STEBBING which was reviewed in a former number of this magazine. Now we have to welcome a book on the pests of crops in Southern India by T. BAINBRIGGE FLETCHER, formerly Government Entomologist of Madras and now Imperial Entomologist to the Government of India. The book is one of some 555 pages with 440 text figures and in addition some 50 coloured plates. The text figures are on the whole good, and the coloured plates are excellent and one should have little difficulty in recognising by their aid the identity of any one of the more serious insect pests. The book should appeal equally strongly to Ceylon students as to those of Southern India, as many of the insect pests referred to are common to both areas. The author has no difficulty in showing the importance of his subject from a financial point of view. Taking 10 per cent. of all crops as a fair estimate of the damage done by insect pests, he comes to the conclusion that in South India the injury done by insects every year amounts to not less than two hundred million rupees, and, when allowance is made for loss due to insect attack on stored products and to insect-borne diseases of man and stock, to not less than three hundred million rupees. A good round sum!

Reference to the contents of the book is made easy by means of a "List of Crops," in which the various plant names are arranged alphabetically. Under each plant the more important pests are listed and to each is attached the number of the page on which the insect is treated of. There is also a very complete general index. The author has included a "List of Allied Plants," in which the commoner plants are grouped together under their Natural Orders, the *raison d'etre* being that particular insects frequently show a predilection for closely related plants—for instance in Ceylon the citrus leaf miner (*Phyllocnistis citrella*, Staint.) attacks also *Atalantia monophylla*, both plants belonging to the N. O. RUTACEÆ.

The book falls naturally into two parts. Pages 1 to 239 give a necessarily brief but nevertheless interesting and accurate outline of the Science of Entomology, while in pages 274 to 546 particular insects are shortly considered under their Families.

While not unnecessarily technical, the author does not hesitate to incorporate into his work the scientific terms used in the Science. And rightly so! One often hears a book commended—and indeed one reviewer, who could not have gone very far into its pages, commended this very book—because it is free from scientific terms. But there can be no real knowledge of, nor progress in, any subject unless one understands the technical terms, which make one's knowledge a unity and not a chaos, and put one into intelligent communication with other workers in the same subject. Every technical term does or ought to indicate ground gained.

Nevertheless, no one who takes up this book from the beginning and reads it with mind alert need have any fear of being overwhelmed by technical terms, and he will thereby have obtained a grounding that will give him an intelligent interest in his pests and perhaps stimulate him to become an investigator.

Those who are shy of technical terms will find much interesting and suggestive matter in the chapters on "Means of Defence of Insects," "Communication among insects," "Tropisms," "Insects and Plants," "Symbiosis and Parasitism," and will perhaps then wish to know more about the science that deals with such interesting phenomena and return to the chapters which they had skipped.

The severely practical man may begin with such chapters as "Insect Pests," but probably he too will find the subject so clearly and fully dealt with that he will finally be induced to take up the more abstruse chapters.

As an example of the method of treatment of particular pests in the second part of the book we shall take the case of *Rhynchophorus ferrugineus*, Fb., The Red Weevil of Coconut. After giving a few references to the literature on this subject the author thus summarises his information on the insect :—

Distribution.—Throughout Southern India, probably throughout the year.

Life History.—Eggs are laid in the soft parts of palms, particularly where cut by toddy-drawers or injured by *Oryctes*. The stout whitish grubs mine through the tissues in all directions and, when full-fed, pupate in a cocoon made of twisted fibres. The complete life-cycle takes about ten months, the adult weevils living two or three months more after emergence from the cocoon.

Food Plants.—Palmyra, date and coconut palms.

Status.—A major pest of great importance in all palm-growing districts.

Control.—All cuts and wounds of palm-tissue should be protected as far as possible by smearing with Tar. The control of Rhinoceros beetle will directly lead to diminution in numbers of the Palm Weevil also. Badly affected trees should be cut down, split up, and burnt."

A full-page coloured plate of the various stages of the insect accompanies the letterpress.

As is well-nigh unavoidable in a book covering so wide a field a few mistakes have crept in. It is not correct to say that 'bugs' thrust into plants a long sucking tube which is *plainly visible* as a long, slender, jointed rod. Nor do larval Syrphids live *entirely* upon aphids, though aphids form the bulk of their food. It is difficult to understand why the dorsal pulsating vessel is *incorrectly* called the heart ; it is chambered, its walls are muscular, it possesses valves, the hæmolymph is nutritive. Is not '*aorta*' equally incorrect ?

It would hardly be practicable to cut out *Batocera rubus* from a *rubber* tree, as the presence of the borer is rarely suspected until the tree has fallen, blown over by the wind.

One is surprised to be told that 'actual facts' may still be open to doubt.!

While the text figures are on the whole good there are several that might have been omitted without a loss to the book. Such are *Mytilaspis piperis* on p. 519 and the adult aphid on p. 506 ; it is no justification to say that they have been prepared by artists who had no previous experience in making drawings of insects for purposes of reproduction.

The larval case of *Tinea pachyspila* on p. 466 would not be recognised as such, in Ceylon at least.

Then it is difficult to understand how the subject of tropic reactions gains in clearness by the diagram on p. 54.

But these are minor points and detract but little from the general excellence of the book. The price is but six rupees, and we do not know of any other entomological work that offers such good value at so low a price. We can strongly recommend the book to all interested, either practically or theoretically, in the subject of entomology.

It may be purchased from the Government of Madras or their Agents.

A. RUTHERFORD.

PRUNING OF ORANGE TREES.

On no account plant below the level of surrounding surface, or so that the original ground level of tree will sink below that plane. It is very much preferable to err on the other side ; the roots will extend downwards where necessary, but the base of stem is a fixture and will remain where placed unless forcibly moved. Nursery stock is not infrequently trained to a long bare stem terminating in a bunch of small branches. Such samples should be cut back to within 18 inches or less of the ground level—in fact, all trees other than those reared in pots should be well shortened at planting, four or five shoots which are to form the main branches being allowed to start at regular intervals. A little extra attention in the early stage and the first two years' growth will, by the removal of surplus and misplaced shoots, not only remove the necessity of later amputation of larger branches, but by directing the growth into permanent channels assist in the earlier development of the tree. No hard-and-fast rules can be followed for pruning young trees, but misplaced shoots should be removed in the earliest stages by a sharp knife and cut close to the base, thus removing any adventitious buds which the practice of rubbing off with finger and thumb allows to remain, to become a perpetual source of trouble and the formation of unsightly callus. The orange being exceedingly susceptible to injury by exposure of its roots, for this reason the handling of young trees must be such as to allow a minimum of exposure. They should not be allowed to become dry under any condition, and the application of water at planting should be as soon after insertion as possible.

—Queensland Agricultural Journal.

[*Photo by H. F. Macmillan.*]

Mountain Papaw (*Carica candamarcensis*). Naturalised in the vicinity of Up-country gardens, about 5,000 feet above sea-level

PAPAW AND PAPAIN.

THE PRODUCTION AND SALE OF THE DRUG.

[*See frontispiece.*]

In view of the popularity of the Papaw fruit and the importance of the extract, papain, obtained from it, the following notes may be of interest. The Papaw tree is a familiar object in many parts of the tropics, being commonly grown in gardens and around native houses, or occasionally cultivated in small areas near towns for supplying the fruit to local markets. Much has been written regarding the well-known fermentative properties of the tree and its capacity for rendering tough meat tender ; many and wonderful have been the stories related concerning it. The tree is a native of tropical America and the West Indies, and was introduced into Ceylon probably early in the seventeenth century, as it is recorded to have been found in the Island when the Portuguese were in possession.

BOTANY.

The Papaw tree (*Carica papaya*) belongs to the natural order Passifloraceæ ; it is small and erect in habit, herbaceous and normally branchless. It bears at the top a crown of large, coarse, palmate leaves, at the base of which are produced short-stalked flowers, which are regular, fleshy, and creamy white. Usually these are unisexual and the tree is generally monœcious, but frequently trees are met with bearing bisexual or both male and female flowers, and these give rise to fruits ; thus "male" trees not infrequently bear fruit, which apparently differ only from that of a female tree by being smaller and perhaps less palatable. The proportion of pistillate and staminate trees from seed of a monœcious parent varies considerably, but usually the former predominate. Numerous species of *Carica* have been recorded and described. The "Index Kewensis" enumerates some twenty-four species. Very few of these, however, are well known, the most familiar being the large tropical papaw (*Carica papaya*), the subject of this article, and the smaller mountain papaw (*C. candamarcensis*). The latter is a native of Ecuador, and is suited only to the higher elevations in the tropics where sub-tropical conditions obtain. This species was first introduced in the Hill Garden at Hakgala, in Ceylon, in 1880, and has now become thoroughly acclimatised and, in places, semi-naturalised. The habitat and character of the tree are similar to those of *C. papaya*, but the fruit is much smaller, pear-shaped and ridged and the tree produces side branches and suckers from the base. The fruit is characterised by an acid flavour, but is good when stewed and sweetened with sugar. It contains little latex or papain, and the latter is not collected in Ceylon. The papaw (*C. papaya*), owing to its natural adaptation to cross-fertilization, occurs in numerous forms or sub-varieties, these varying chiefly in the shape and size of fruit. Some contain a large quantity of seeds, others are seedless. The flavour of the fruit varies to some extent in different varieties, as also does the proportion of papain, or milky juice, present. Fanciful names are sometimes given by plant-dealers to different varieties, but such names are usually misleading, as for example the "Ceylon," "Fiji," "Madagascar," and "New Zealand" papaw ; these names are unknown in the countries indicated.

THE FRUIT.

The large, green, fleshy and gourd-like fruit varies in shape, and also somewhat in flavour, in different varieties; in some it is almost round, in others oblong or oval (the latter the most common form), being usually about 7 to 9 inches long by about 4 to 6 inches in diameter. The fruit may weigh from about 3 lb. to as much as 7 lb. or more. The flesh or edible pulp varies in thickness from about 1 to 1½ in., and in colour from a light pink to a light orange tint. It is of a soft, melting consistency, refreshing and agreeable to the taste, especially on first acquaintance with it. It is commonly used as a table fruit in hot countries, and is comparable to a sweet lemon ; hence it is sometimes called the "tree-lemon." In an unripe state it is sometimes boiled and used as a vegetable, or cut into cubes and pickled, or made into a preserve. Those fruits having the least number of seeds are usually the best flavoured. In common with the leaves, which are used for wrapping round fresh meat in order to render it tender, the fruit contains a powerful ferment, and cooks frequently take advantage of this property and make use of it in cooking, either by rubbing the juice on the meat, or by placing a piece in the water in which the latter is boiled. A tree will produce forty to sixty fruits or more a year during the first few years of its life. The fruit is commonly retailed in the local markets at from 8 to 20 cents (= 1½ to 3½*d.*) each, according to size and locality, and is supplied in rather large numbers to the hotels in Colombo and the shipping in the harbour. It has the disadvantage of being easily damaged by bruising, and has consequently to be handled very carefully. The centre of the fruit consists of a large hollow cavity, with the seeds (if any) attached to the walls along the placenta. The seeds are usually very numerous, but sometimes few or none ; they are of the size of small peas, olive-coloured, with a soft and slimy surface. Their flavour is rather pungent, resembling watercress, and is relished by some persons in salads. About 3,500 seeds, when fresh, go to a pound, and about 4,500 when moderately dry. Fresh seeds take from ten to fifteen days, or longer, to germinate, according to age : old and much-dried seeds take from one to two months longer.

PROPAGATION AND CULTIVATION.

The Papaw tree is propagated invariably from seed, but its propagation by cuttings and grafting is possible, though seldom practised. For the cultivator, there is little to be gained by a vegetative method of propagation, as seeds germinate very readily and seedling plants make the healthier and more productive trees than rooted cuttings or grafts.

Papaw-seeds, if sown fresh, should, as has already been said, germinate in a fortnight or a few weeks, according to age, the older seed taking longest. The seedlings grow rapidly, and the trees may be planted out at about 10 by 8 ft. apart, allowing, say, 540 to the acre. They commence to bear fruit when about a year old from seed, and continue fruitful, without intermission, until they become too old or exhausted. At the age of about four years, when it should have produced at least 160 fruits or an average of about fifty a year, the tree becomes too unproductive for profitable cultivation, the fruits then becoming fewer and much reduced in size. The papaw-tree is suited to a hot and humid climate, thriving from sea level to about 3,000 feet elevation. It affects a rich loamy soil and does not withstand drought (unless well irrigated) or a dry gravelly soil.

Some attention has recently been given to the improvement of the Papaw under cultivation, more particularly in regard to yield and uniformity of fruit. MR. KULKARNI of the Bombay Agricultural Department, describes a successful experiment undertaken to induce the branching of the papaw tree. This was effected by removal of the growing point at the top, which in a fortnight was followed by the production of several shoots below the wound. These in due course fruited, and the product of two branched, compared with that of two normal and unbranched, trees during three months (December to March) gave the following result :—

5 branched trees	averaged	38	fruits,	averaging $2\frac{1}{2}$ lb. in weight
5 unbranched trees	,,	23	,,	,, $2\frac{3}{4}$ lb. ,, ,,

It will thus be seen that though the fruits were smaller individually, the branched trees gave a much larger number ; the total weight, however, of these was only one pound greater than that of the crop from the normal unbranched trees. It is stated that the branched trees were less frequently damaged by winds, and that " the fruit was easy to watch and harvest." In Ceylon, however, it is neither necessary nor advisable to induce branching of the papaw tree.

Thinning out of the fruits, in order to increase their size, may be recommended if large and well-shaped fruits are especially desired. In this way fruits of greater uniformity as well as of somewhat increased size may be produced. Grafting experiments have been conducted in the Philippines and elsewhere with a view to establishing select varieties and eliminating male trees or undesirable sorts : thus by grafting " female scions " on " male " stocks, fruits of a large size and more or less uniform quality could be relied upon. In practice, however, it is doubtful whether this would be feasible or worth carrying out.

PAPAIN.

In recent years the papaw has come into prominence on account of the drug papain obtained from the fruit. The usual manner of collecting this is by making light superficial incisions or scratches in the unripe fruit while on the trees, using a bone knife or other non-metallic instrument for the purpose ; incisions need not be more than about $\frac{1}{4}$ in. deep and about $\frac{1}{2}$ in. apart. The milky, viscid juice immediately exudes from the cuts and is collected in porcelain, enamelled or glass dishes ; it coagulates naturally, forming a resinous-looking granular mass, and is then dried in the sun. It must be dried rapidly, otherwise it putrifies and gives off an unpleasant sour odour. To obviate this a trace of formalin should be added to the juice when collected. The tapping, i.e. the process of obtaining the juice by incisions, may be repeated at intervals of two or three days, but unless this is done carefully the fruits are liable to wilt and dry up. The early morning is the best time to tap, the flow being then most abundant.

In Ceylon, where the collection and preparation is entirely in the hands of the peasants, the drying is invariably effected by laying the coagulated milky juice on plates or enamelled dishes in the sun. When dry, it is packed in bottles or jars for export. No agent is used in Ceylon for hastening coagulation, which rapidly takes place on exposure of the juice to the air. The average yield of papain per tree is variously estimated : in Hawaii it is placed at 1 lb. per tree, but from experiments made in Ceylon $\frac{1}{2}$ to $\frac{3}{4}$ lb.

per tree per annum would be considered a good yield. A dozen average sized fruits should yield about 10 to 12 oz. of the coagulated material at one tapping; this on drying should give 25 per cent. of its weight in dry powder, the latter containing about 25 per cent. of the active principle papain. In the native villages, where papain is chiefly collected, the preparation is neither carefully made nor clean, and, like many other preparations, it is liable to be adulterated, arrowroot starch, rice conjee, or flour being found a suitable medium for this purpose. There seems no evidence, however, that, as is sometimes supposed, the milky juice of other plants is used as an adulterant in Ceylon, even in remote villages, where the collection of papain is chiefly carried on. MR. C. DRIEBERG, Secretary of the Ceylon Agricultural Society, who has at one time or another devoted his special attention to the subject, confirms this statement.

MR. KELWAY BAMBER, F.I.C., F.C.S., Government Chemist, Ceylon, has found that the granulated material can be purified by straining the juice through fine muslin and adding three times its volume of alcohol, the pure papain being then precipitated. It is next collected on filter paper, and the product dried, the yield being about 2·50 per cent. The process, however, is too expensive and troublesome to make the result remunerative, and it is considered that the purifying process adopted in the countries of importation is less costly, though equally satisfactory.

PAPAW IN THE PACIFIC.

The papaw-tree is also grown largely in the Hawaiian Islands, and from a pamphlet which has recently been issued by the Hawaii Agricultural Experiment Station, it appears that the manufacture of papain is beginning to receive attention in those islands. There are no difficulties, it is stated, requiring great skill in collecting and preparing the juice for market, but care is necessary. The fruits abound in juice, particularly when the tree is young and during the warm weather after rain. The flow is free at first, and the liquid is caught in porcelain glass or earthenware vessels. Coagulation soon begins, and the mass must be scraped from the surface of the fruit. In most places where the industry is conducted labour is cheap, but it would be seen that a more convenient and efficient vessel could be devised which could be quickly put in place to receive the juice, permitting the operator to proceed to the next tree. As the juice flows freely in the early morning it is usually collected then, and dried wholly or in part during the remainder of the day. Sun-drying is followed to some extent, but artificial means, such as are furnished by a fruit drier, are preferred. In Montserrat several driers have been made for the purpose and operated by companies buying the juice from the peasants, who gather it. One form of drier is 3 ft. by 3 ft. and 6 ft. in length. The sides and ends are of brick, with an opening at one end for the flue and at the other end to admit fuel; the top is open. About a foot below the top a sheet of iron is placed, and upon this is an inch or two of sand to modify and distribute the heat arising from the fire beneath. The coagulated juice is spread upon brown linen stretched upon frames, which are made to fit the top of the drier. The drying must be effected with low temperatures, as great heat destroys the ferment. A temperature below 100° F. is preferred by some operators. The coagulated material may be placed upon sheets of glass while drying, When dry and flaky it may be ground in a coffee-mill, and should then be in the form of a white or cream-coloured powder, which should be placed in bottles and tightly closed.

PROPERTIES OF PAPAIN.

The peptonising or digestive power is well known, and it is considered a good substitute for animal pepsin, but unlike the latter, it requires neither the aid of an acid nor an alkali to convert the contents of the stomach into a peptone. The celebrated chemist VAUQUELIN compared papain to "blood deprived of its colouring matter." The material has not, however, come into extensive use in medicine, its consumption at present being chiefly confined to America, where it is much used in the treatment of chronic dyspepsia, gastritis, diptheria, etc., and it is also recommended for eczema. In Ceylon it is not used medicinally, except perhaps in native medicine. It is described, however, in WARING'S INDIAN PHARMACOPŒIA and DYMOCK'S MATERIA MEDICA OF WESTERN INDIA. Papain has the effect of curdling milk, like rennet, and might be used as a substitute for the latter. The demand for papain is, of course, limited, and the present supply appears to come almost entirely from Ceylon and the West Indies, more especially the island of Montserrat.

COMMERCE.

The export of papain from Ceylon is in the hands of a few firms who buy from the villagers in the interior, mostly in the districts of Kurunegala and Kegalle, and pay from about Rs. 5 to Rs. 7 per lb. The purified commercial papain fetches round about 12*s.* (Rs. 9) per lb. in the European markets. The following is a statement from the PRINCIPAL COLLECTOR OF CUSTOMS, showing the exports from Ceylon during the three years 1911, 1912, and 1913. This gives an idea of the local output and the destinations:—

Countries to which exported.	1911		1912		1913	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
	lb.	Rs.	lb.	Rs.	lb.	Rs.
United Kingdom	4,054	20,320	9,088	34,332	12,705	44,185
Foreign countries						
Belgium			76	229	376	1,881
Germany	2,007	11,401	1,708	7,159	2,555	12,705
United States of America	550	2,500	2,048	8,948	2,912	13,078
Total	6,611	34,221	12,920	50,668	18,548	71,847

The United States is the largest consumer, importing annually it is estimated, to the value of £15,000 to £16,000. The price paid in the States for papain varies from 7*s.* 6*d.* to 15*s.* per lb. according to quality, as tested to determine its digestive properties. According to THE CHEMIST AND DRUGGIST the demand for papain at present exceeds the supply, as the American importers insist on a light-coloured papain, which is difficult to procure.

Some time ago Jamaica maintained an industry of some importance in collecting and preparing the juice for the market, but it has now shrunk to negligible proportions. Later, the business grew up in the island of

Montserrat, which became the chief producer in the West Indies. It is a little doubtful, however, whether the trade is likely to increase. Prices have fallen considerably in recent years, but within the past six months they have shown a distinct advance.*

Opinion among large consumers appears to be divided on the present question of the supply and demand, for while some state that the consumption of the drug is on the increase and the prospects are good for marketing larger quantities, others affirm that the only means of extending the market would be in the production of a more carefully-prepared product which would replace the cheaper and adulterated grades, of which considerable quantities are sold. In the course of an article on papain in the JOURNAL OF THE ROYAL SOCIETY OF ARTS (September 1913), the statement was made that

"The United States prefer the inferior qualities from the West Indies, and also desire a white or bleached papain, which the Ceylon natives are not always in a position to supply. Importers, however, could, without much difficulty, procure an almost unlimited supply of the best unadulterated Ceylon papain if they were willing to pay a slightly better price for it than for the West Indian product, and would accept it in its natural state."

DR. HUYBERTSZ, of Kandy, who has devoted some attention to the preparation of papain states that "European and American importers object to papain in its natural colour, and insist that it be white, or at least, light. This, he says, is a great mistake, as it can only be obtained by bleaching—a process which sacrifices therapeutic efficiency for pharmaceutical appearance. Genuine papain is slightly saltish and somewhat acrid. It has a peculiar, unmistakable smell, and the "feel" of granular papain should be crisp, like biscuit, and easily crushed between the fingers. When it is doughy or sticky it has been adulterated or badly prepared. It has also slight escharotic action, and collectors of the fresh juice frequently blister their fingers. When mixed with water it has a soapy feel." Up to a comparatively few years ago the value of papain was little understood, and it was mostly used in making mucilaginous products and chewing-gums. Since then the United States, Germany, and Great Britain have taken considerable quantities, and it enters into many preparations. Recently America has found a new use for the drug, but what this is has not yet transpired.

H. F. MACMILLAN.

RAINFALL FOR DECEMBER, 1914.

Place	1914	1913	Place	1914	1913
	in.	in.		in.	in.
Colombo	5·25	5·72	Kurunegala	14·91	8·57
Kandy	14·36	13·91	Batticaloa	21·73	14·70
Galle	6·20	12·35	Badulla	14·77	14·94
Jaffna	17·89	6·11	Ratnapura	9·44	10·89
Anuradhapura	13·95	3·20	Nuwara Eliya	10·79	12·91

* THE CHEMIST AND DRUGGIST for January, 1915.

CO-OPERATION.

AGRICULTURAL CREDIT ABROAD.

A summary of the progress of the Agricultural Credit of the French Colonies and Roumania taken from the MONTHLY BULLETIN OF ECONOMIC AND SOCIAL INTELLIGENCE, Nos. 7 and 8, Vol. IV., July-August, 1914, published by the INTERNATIONAL INSTITUTE OF AGRICULTURE BUREAU OF ECONOMIC AND SOCIAL INTELLIGENCE, containing an interesting account of the work that is being carried on in those countries in connection with the problem of furnishing agricultural credit to farmers, is given in an issue of the "Communication to the Press."

In Algeria the Bank of Algeria is required to pay the Government in the interest of Agricultural Credit the following amounts annually, namely :--

200,000 francs from 1st January, 1900, to 31st December, 1905.
250,000 francs from 1st January, 1906, to 31st December, 1912.
300,000 francs from 1st January, 1913, to 31st December, 1920.

This is in addition to a sum of three million francs that the Bank is required to place at the disposal of the treasury free of interest during the whole term of franchise.

In 1901 a Law was passed to further the mutual credit movement by making provision to establish regional banks. The funds provided by the Bank of Algeria are to be distributed among these banks by the Governor of the Colony. At the end of 1912 there were already in activity 37 regional agricultural credit banks with a subscribed capital of 3,752,445 francs, of which 1,454,337 was paid up. The reserves of these banks amounted to 742,437 francs. 249 local banks with a membership of 15,000 have been affiliated to these regional banks.

Of these seven are native banks having been formed exclusively of natives and the Government gives every encouragement to the formation of these banks, with the object of diffusing the advantages of mutual credit among the Arab population.

In Tunis the "Regional Agricultural Mutual Credit Bank of the North" was formed in 1905 and 24 local and 54 native banks have been affiliated to it. This Bank of the North enjoys a discount credit of 800,000 francs with a private Company in addition to a sum of 200,000 francs received from Government.

Colonial banks in the other French Colonies, viz., Martiniqe, Guadaloupe, Réunion, and Cayenne, grant loans to colonists on furnishing signed bills on the security of their crops—the amount of a loan being an amount equal to one-third of the estimated value of the crop.

The Indo-China bank was organised newly on the same lines to relieve the colonists from paying usurious interest on money borrowed for agricultural pursuits; the ordinary rate of interest there being 36 or 42 per cent. and at times rising up to 80 or 140 per cent.

In Madagascar the extension of rice cultivation caused the existence of mutual agricultural institutions among the natives who deliver their rice at the warehouse and receive an advance enabling them to wait for a subsequent rise in price.

In Roumania the development of the Co-operative movement is very significant. In 1912 the total number of Co-operative Societies was 3,556 with a membership of 592,360 and a paid up capital of 84,390,958 *lei* (a lei being approximately equal to a franc).

These societies established a system of collective farms which is an effective defence against the capitalistic monopoly in the shape of land-leasing trusts. The following figures will show how rapidly these farms have increased in number, thanks to the encouragement given by the State.

In 1903	the number of farms was	8
,, 1909	do	273
,, 1911	do	378
,, 1912	do	487

These 487 farms have an area of 370,000 hectares for which societies pay a rental of 12,404,085 *lei* or an average of 33 *lei* per hectare. The invested capital of all the societies is 3,944,068 *lei* and their total turnover 47 million *lei*.

Unlike the Italian collective farms, the farms in Roumania are all worked individually. The societies lease the land from the State, from public bodies or from individuals and grant them to individual members for cultivation.

Among the benefits generally attributed to the creation of collective farms in Roumania are the following:—

(1) The elimination of the profit of any intermediary, the agricultural labourers united in societies holding the land directly from the proprietor.

(2) The fact that the advantages of large scale production are brought within the reach of small cultivators who through the society are able to acquire and utilise modern improved implements and raw materials of superior quality.

(3) An increase in the area of land under scientific cultivation.

It is said that this system has increased the area under scientific cultivation as these societies are generally under the trained agriculturists who are responsible for improved methods of cultivation being adopted.

FARMERS' COMMUNITIES IN SPAIN.

A Law was passed in 1898 making provision for establishment of Farmers' Communities.

These are associations of land proprietors formed for the protection of the rural holdings in their own community, and with the following special objects:

(a) To provide for the protection of farms and agricultural produce;

(b) To promote the opening of rural roads and provide for their maintenance;

(c) To keep watercourses and dams in good repair.

(d) To provide, in general, for the maintenance of public order and the supervision of the rural police.

The total number of these institutions is about 80. In addition to this work already mentioned the Communities have other important functions, namely to form Co-operative Societies for credit and for purchase and sale.

One of these Farmers' Communities is the one called Villarreal Farmers' Community. It had in 1913 a membership of 4,750 and a satisfactory balance to the credit of the society at the end of the year. This institution in the same year caused a diminution of 74 per cent. of the number of cases of contravention of the law of property from the number reported in the first year of the association's activity. 5,985 metres of new roads were added to the list in additon to building protecting walls, culverts, etc.

It also helped the farmers in their struggle against the damage done by a scale insect by providing them with spray diffusers.

The most recent and not the least important enterprise of this community is the establishment of a loan and Savings Bank.

In 1912 this bank received 864 deposits to the value of 305,662 *pesetas*. 316 loans on personal security and 41 loans on mortgages were given. The maximum interest on deposit is 4 per cent. and maximum rate of interest on loans is 6 per cent. per annum.

N. W.

ENGLISH POTATOES.

Several varieties of English potatoes were planted at the Peradeniya Experiment Station on November 15th, 1914. Two whole tubers of each variety were planted and the crop harvested on February 1st, 1915. No special attention or manure were given them. The following is the result :—

TUBERS.

	VARIETY.	BIG.	SMALL.	LB.	PLANTS.
1.	Brownell's Beauty	9	8	$1\frac{3}{4}$	2
2.	Up-to-date	9	11	$1\frac{1}{2}$	2
3.	Cambridge Kidney	0	3	$\frac{1}{2}$	1
4.	Imperator	7	3	$\frac{5}{8}$	2
5.	School Master	5	9	$\frac{7}{8}$	2

The three best varieties have been stored in dry sand and will be tried again with more attention in June.

Very fine Kew pines have been raised.

D. S. CORLETT.

RAINFALL FOR JANUARY, 1915.

Place	1915	1914	Place	1915	1914
	in	in		in	in
Colombo	1·48	·19	Kurunegala	4·72	·81
Kandy	8·78	2·78	Batticaloa	23·08	16·76
Galle	4·08	1·17	Badulla	12·86	8·32
Jaffna	2·61	1·35	Ratnapura	5·38	1·70
Anuradhapura	4·98	1·42	Nuwara Eliya	8·05	2·17

GENERAL.

THE OIL PALM.

R. E. BENNETT, FORESTRY DEPARTMENT, NIGERIA.

Let me tell you something about the palm-tree and its products. First, the palm-tree zone may be roughly described as the country lying between Sierra Leone and the Lake district on the north and Ambriz and the borders of German East Africa on the south. The bulk of the trade in the palm oil tree products are shipped from the ports of Sierra Leone, Ivory Coast, Gold Coast, Dahomey, Nigeria, the Cameroons, Gaboon and the Congo.

The tree is found dotted about in the denser forests and adds very greatly to the charm of the view of clearings in the bush. Where clearings have been made for farming purposes and then abandoned, plants spring up from seeds that have been lying dormant for some years, so that the palm forest in such a place becomes a very dense one. The fruit is gathered by the native, who, with the help of a native-made rope encircling the trunk of the tree and his body, climbs up the tree and cuts down the fruit with a cutlass called a "matchet," generally speaking made in Germany.

The crown of the palm-tree is formed of a graceful collection of palm leaves, between which the inflorescence and the fruit lie hidden. The fruit when cut is often carried to the nearest market and sold for immediate consumption. The male and female flowers are usually both borne on the same tree, but not on the same flowering stalk. Uni-sexual inflorescences, however, are sometimes met with. The male inflorescence emerges as a spike surrounded by a covering sheath, which it bursts through as it develops. The male flower is borne in the axils of leaves two cycles younger than and immediately above the female flower, and this ensures that pollination takes place. An oil palm starts to produce male blossoms when three years old ; it bears male blossoms from one to three years before female blossoms appear. After the male flower has produced pollen it dies.

People who have little or no knowledge of the palm-tree (*Elaeis guineensis* confuse the palm fruit with the palm kernel. The palm kernel of commerce is the seed of the palm-tree. This is surrounded by a hard shell, and it is then called the palm nut. This shell is in its turn covered by an oily fibrous matter, and is then known as the palm fruit. If we take this fruit and cut it into two parts, we can see these three parts of the fruit more distinctly ; first the outer yellow covering or the fibrous pericarp, from which the palm oil of commerce is extracted ; then the shell, and finally the kernel, from which the white palm kernel oil is extracted.

The composition of this fruit is as follows :—

Pericarp oil	...	...	18 per cent.
Fibre and moisture	...	...	12 ,,
Shell and disk	...	...	58 ,,
Kernel ...	...	...	12 ,,
Total		...	100 ,,

The uses of the palm oil tree are various. It yields the palm oil and kernels of commerce. It gives the native a drink he is very fond of, called palm vine, which, when fermented, gives our cooks yeast for bread-making. The shells of the nuts are used by blacksmiths as fuel, as they give off great heat.

The growing point of the palm when cut out and cooked is used as a vegetable, but as this operation kills the tree this dish is a very expensive one. The stems of the leaves are used as rafters, and the leaves for making mats for roofing. From the mid-ribs the native makes brooms.

The trade in palm oil and kernels was unknown in the days of BOSMAN and BARBOT (1705-1760); at least they make no mention of the trade in their books. The palm-tree, however, was described by both as a source of native food, "since," as they quaintly put it, "with the help of bread and fish it subsists most of the people on the coast." "The first produce of this tree," BOSMAN writes, "is its nuts, which, roasted when young, taste very deliciously, and when old are covered with a red husk or shell, black on the hinder part, and contain the palm oil, which is obtained by contusion and expression as that of olives. After the oil is expressed the pulp serves the negroes for a delicacy: and if kept till old is extraordinarily good to fatten hogs, and renders their *flesh very firm*." (Our farmers should note this.) "The second fruit it yields is the wine itself. The wine being drunk fresh or under the trees, as our phrase runs here, is very delicious and agreeable; but withal so strong that it unexpectedly steals to the head and very speedily intoxicates." What we learn from the above remarks of BOSMAN is that the value of the palm-tree as a supplier of food and drink was well known to the natives in his day.

Who first taught the natives how to prepare palm fruit for food purposes we cannot say, but we may suppose that the preparation of oil and kernels for sale to the white man is merely an extension of the earlier process. At the present time there are three methods of making palm oil: (a) from the fresh fruit, (b) from partially fermented fruit, and (c) from well fermented fruit.

Bunches of fruit having been severed from the parent tree are sliced and hammered by natives, using long poles, until the fruit becomes detached from the bunch. The fresh fruit is either prepared at once into what is called soft oil, or allowed to ferment, or partially ferment, and made into hard oil. The procedure followed in making either of these kinds of oil is much the same. The fruit is placed either into canoes or clay troughs, water is poured over them, and then, by treading or beating, the fibrous matter containing the oil is separated from the nuts. The nuts are then taken out and placed in the sun to dry, while the fibrous matter, by further beating or treading, is made to yield the oil which floats to the surface of the water. This oil is ladled out into pots and boiled, and then allowed to rest, so that all dirt or sediment falls to the bottom of the pot. This clean oil, soft or hard, is the palm oil of commerce. This oil is taken in calabashes or tins to the traders' factory, which, generally speaking, is near to a river or a railway, and there put into casks and sent to the nearest port for shipment to Europe.

As I have pointed out, there are, practically speaking, two kinds of palm oil exported from the West Coast, i.e. hard and soft, but soft oil is of two qualities—Lagos and ordinary soft oil. As a rule, Lagos and soft oil is worth £3 to £4 more than hard oil, the reason being that there is about 8 per cent. more glycerine in the soft than in the hard. The percentage of glycerine varies in inverse proportion with the acidity.

Crude glycerine is worth £50 per ton.

Palm oil is put to a variety of uses, but it is chiefly used for the manufacture of soap and candles.

In the manufacture of tin plates the iron plates, before being dipped into the molten tin, are covered with palm oil to prevent oxidation. It is also used in the manufacture of certain substitutes for butter, after refining

The leakage from casks of oil in the ships bringing them to Europe is used in the making of metal polish. Railway companies use it for greasing the axle boxes of railway carriages.

PALM NUT CRACKING.

In the olden days one of the chief occupations of slaves was that of cracking palm nuts. Now this work is left to boys and women. After the nuts have been dried in the sun, they are heaped up under little sheds to protect them from the rain. In places where rocks are plentiful the nuts are taken there and cracked on them by a stone held in the hand of the cracker. In other places the nuts are put on a block of wood resting on the ground between the cracker's legs and struck with a piece of iron held in the cracker's right hand. In this way one worker will crack from 15 lb. to 25 lb. of kernels per day. The kernels are then packed in different kinds of baskets and taken to markets near rivers, where they are bought by native middlemen. Competition is very keen, and so these middlemen are tempted to adulterate the kernels by adding shells to them or by soaking them in water for two or three days. Finally, they are taken in canoes down rivers or by rail to the European traders and sold by measurement at so much a bushel.

I have given you this sketch of the African manufacture of palm-tree products to show you how industrious and busy the natives really are, and what an enormous number of Africans will suffer if this cruel war continues, and Nigeria is not able to dispose of the kernels she used to export to Germany. Think of it ! 241,000 tons of palm kernels shipped to Hamburg in 1913, and nearly every nut containing one kernel is cracked by hand as I have described.

As I have already said, nearly the whole of the palm kernels sent to Germany are received through Hamburg. The following table gives us the total value of the palm kernels exported from Nigeria for the last seven and a half years. It also shows how much larger the Nigerian exports to Germany have been, as compared with those to the United Kingdom.

Year.	Total Value.	United Kingdom.	Germany.	Other Countries.
	£	£	£	£
1907	1,658,000	286,000	1,334,000	38,000
1908	1,425,000	231,000	1,093,000	101,000
1909	1,816,000	179,000	1,500,000	137,000
1910	2,450,000	300,000	2,072,000	78,000
1911	2,574,000	319,000	2,166,000	89,000
1912	2,797,411	365,462	2,175,736	(?)
1913	3,109,820	511,541	2,005,626	92,653

For the last six months ending June, 1914, Germany has received £1,171,093 worth, thus keeping up her trade in palm kernels with Nigeria up to the date of the declaration of war.

You will have noted that not only does the greater part of the kernel trade go to Germany, but that the whole of our kernel cake goes there too. This goes to show that, in spite of the fact that the African knew 200 years

ago that the kernel made the flesh of hogs firm, the farmers in the United Kingdom will not use palm kernel cake, and that because the German farmers do, Germany gets the greater part of our exported kernels.

There are only a few kernel-crushing mills in England, and these are near to Liverpool. The reason given by the mill-owners for the scarcity of mills in England is, as I have said, that our farmers will not use the cake made from palm kernels. This seems to me to be a very great pity, for the great need of oil extracted from the palm kernels is admitted by our soap and butter manufacturers. Our farmers are very conservative, we know, but is our Agricultural Department doing its best to teach them the lesson the Negro learnt so long ago ?

USES OF PALM KERNELS.

Palm kernels are used in Germany as a source of oil (palm kernel oil) and feeding cake (palm kernel cake). The average value of the kernels in Hamburg ranges from £18 2*s*. to £19 2*s* per ton (June 20, 1914), the value of the oil being £38 13*s*. to £39 13*s*. per ton and of the cake £6 8*s*. to £6 12*s*, per ton on the same date. Later Hamburg quotations are not available. The value of the kernels in Liverpool was £17 17*s*. 6*d*. to £18 18*s*. 9*d*. per ton in July last. Roughly speaking, one ton of kernels will make half a ton of kernel oil and half a ton of cake, value, say, £22.

PALM KERNEL OIL.

The quantity of oil yielded by the kernels varies from 46 per cent. to 53 per cent. Practically all the palm kernel oil of commerce is expressed in Europe, the chief centre being Hamburg, though some is expressed in Liverpool. Attempts have been made to express the oil on a large scale in West Africa, but these have not proved very successful. The natives prepare small quantities of palm kernel oil by crude methods, but this is entirely for their own use. On the commercial scale palm kernel oil is obtained either by extraction with solvents or by expression. In the latter case, the crushed kernels must be pressed twice, on account of the large amount of fat contained by them. The first expression is usually carried out at a temperature of 45°—50° C., and the second at 55°—60° C. By this means about 43 per cent. to 45 per cent. of palm kernel oil is obtained, corresponding to a yield of about 1,000 lb. of oil per ton of palm kernels. By extraction with solvents the whole amount of oil, or any desired proportion of it, can be recovered at will, but if all the oil is taken out the residual meal is less valuable as a feeding stuff, and in addition it is frequently asserted that the cake is then unsuitable for use as a feeding stuff, and that the oil obtained is not of edible quality. It is, however, fairly certain that with proper care, and the use of suitable solvents, the residual meal can be obtained suitable for feeding purposes, and an oil of edible quality prepared by extraction processes.

Palm kernel oil at European temperature is a white or pale yellow solid fat possessing a pleasant nutty taste. It closely resembles coconut oil in appearance and properties.

Palm kernel is used for the same purposes as coconut oil, viz., the manufacture of soap and candles, and the preparation of various edible fats, such as palmine, margarine, cooking fats, vegetable "butters," and chocolate fats. By suitable treatment it can be separated into a liquid portion (olein), and a hard white fat (palm kernel stearin), and in this way the consistency of the material can be varied for the preparation of different edible products. These edible palm kernel oil products are prepared on a very large scale in Germany and elsewhere, and are largely imported into this country. With palm kernels at £17 to £18 per ton, the value of palm kernel oil in the United Kingdom is from £36 5*s*. to £36 15*s*. per ton, with Ceylon coconut oil at £40 per ton. The price of butter made from this oil is 8*d*. per pound.

PALM KERNEL MEAL.

The meal which is left, after expression or extraction of the oil from palm kernels, is of value as a cattle food. The cake has not a very pronounced flavour, and is usually fed in the dry state. In Germany it finds a good sale, especially as a food for young pigs, and, like coconut cake, it is said to improve the fat content of the milk when fed to cows, On this latter point, MR. E. W. THOMPSON, Commercial Agent of the Department of Commerce of the United States, who has recently investigated the possibility of increasing the market for American cotton-seed meal in Germany, says :—" Palm kernel meal from the local (German) mills has made a fine reputation as a milch cow feed, and it sells itself."

On the question of the suitability of palm kernel meal prepared by extraction processes for feeding purposes, the same author says :—" Palm kernels are largely worked by the solvent process, delivering meals with about 19 per cent. protein and 2 per cent. (fat, as compared with 18 per cent. protein and 8 per cent.,) fat for meal from hydraulic presses. The digestibility of the solvent meal (known in Germany under the general name "Schrot") is more satisfactory than the other—80 per cent. against 73 per cent."

The following table gives the composition and current value of palm kernel cake in comparison with coconut, linseed and cotton-seed cakes :—

Name of Cake.	Composition, Per cent.						Current Value, per ton.
	Moisture.	Crude Protein.	Fat.	Carbo-hydrates (by difference).	Crude Fibre.	Ash.	
Palm kernel cake (1) expressed ...	9·7	17·7	8·6	36·2	23·8	4·0	£6 8*s*. 0*d*. to £6 12*s*. 0*d*. (Hamburg, June, 1914).
(2) extracted ...	10·9	18·7	1·6	39·1	25·4	4·3	—
Coconut cake (expressed) ...	10·5	21·4	8·5	38·7	14·7	6·2	£7 8*s*. 0*d*. to £8 3*s*. 0*d*. (Hamburg, June, 1914.)
Linseed cake (1) expressed ...	11·0	33·5	8·6	31·7	8·7	6·5	English, guaranteed 95% linseed, £8 12*s*. 6*d*. to £8 17*s*. 6*d*. (Hull, Sept. 1914).
(2) extracted ...	10·2	37·4	3·8	32·7	9·1	6·8	No quotation available.
Cotton seed cake (1) decorticated ...	8·0	46·2	8·9	22·9	7·0	7·0	English, £9. 5*s*. 0*d*. to £9 7*s*. 6*d*.
(2) undecorticated (both expressed)	10·5	24·5	6·5	26·3	25·0	7·2	English £6 5*s*. 0*d*. to £6 7*s*. 6*d*. (Liverpool, Sept. 1914).

THE MARKET FOR PALM KERNEL OIL AND MEAL.

A considerable proportion of the palm kernel oil produced in Germany is exported either as such or in the form of prepared edible and other fats, but practically the whole of the palm kernel cake or meal made is consumed in the country itself, the consumption in 1912 amounting to 120,000 out of a total of 138.816 metric tons produced (THOMPSON : *loc cit*).

In the event of the palm kernels now exported to Germany from British West Africa being diverted to this country, British oil-seed crushers who undertook to work them would find no difficulty in getting a market for the oil among soapmakers and makers of edible fats in this country. There might, however, be some difficulty in finding a market quickly in this country for the palm kernel cake, owing to the fact that English farmers are extremely conservative, and do not readily take up feeding stuffs which are new to them. It is stated, for example, that this very conservative attitude of the English farmer is largely responsible for the decline in the imports of soya beans to the United Kingdom in the last year or two, owing to the fact that it proved impossible to create a large market in this country for soya cake, although it rapidly became popular in Germany.

The manufacturer of palm kernel cake in the United Kingdom would therefore probably have to depend largely at first on the makers of compound cakes to absorb his produce, but in face of the abundant German evidence of the high feeding value of palm kernel cake, it should not be difficult for the manufacturer to gradually popularise this material among farmers and cattle keepers in the United Kingdom.

There is room for an enormous extension of the production of feeding cakes in the United Kingdom, since no less than 406,700 tons of such cake valued at £2,539,892 were imported, chiefly from foreign countries, in 1913. The imports are principally cotton-seed, linseed and rape-seed cakes.—

UNITED EMPIRE.

PUSA INSTITUTE AND COLLEGE.

The annual report on the Agricultural Research Institute and College at Pusa for 1913-14 is to hand, and comprises reports from the following officers:—

The Director (BERNARD COVENTRY), Agriculturist (A. C. DOBBS), Agricultural Chemist (J. W. LEATHER), Economist Botanist (A. HOWARD), Mycologist (F. J. F. SHAW), Entomologist (T. BAINBRIGGE FLETCHER), Pathological Entomologist (F. M. HOWLETT), Agricultural Bacteriologist (C. M. HUTCHINSON), Cotton Specialist (G. A. GAMMIE).

Among the major investigations in progress under the Agriculturist we note "the puddling of rice land by the double engine system of steam cultivation," and await the final report with much interest. In the Mycologist's report reference is made to the following diseases of rice (1) "Uffra" caused by an eel worm (*Tylenchus angustus*). It is noted as a curious fact that transplanted paddy is comparatively immune from the disease. The burning of stubble after harvest is recommended as a preventative measure. The losses caused by "uffra" are very heavy. (2) *Sclerotium Oryzæ* is a fungus attacking rice in Burma, Madras and also in Bihar and Orissa. The symptoms are excessive tillering and lightness in the grain, frequently nothing being found within the glumes. (3) Rice Bunt is caused by *Tilletia horrida* and (4) False smut by *Ustilaginoidea virens*. The spores of the former were found in rice from Burma and Siam.

In manuring tobacco land with Sunn hemp (*Crotalaria juncea*) it was found that a period of two months after burying the green stuff was necessary for the best results, until a certain stage is reached in the decay of green crop like Sunn hemp it is possible that the excess of CO_2 and absence of Oxygen would limit the growth of the following crop, whether tobacco or paddy.

The Cotton Specialist referring to cultivation of Cambodia cotton in Madras refers to the crop raised at the Hagari Station where the outturn was 631 lb. of seed cotton per acre and the ginning percentage 37·5. The value of the lint per acre was about Rs. 90/-, which is considered very satisfactory. The spacing recommended for Cambodia (now being grown at the Mediwaka garden in Upper Dumbara) is 3 ft. by 1 ft.

C. D.

COMPOSITION OF CASSAVA.

The following analyses of three typical varieties of Cassava were made in the Chemical Laboratory of the Philippine Department of Agriculture. A note on the subject says that ·04 gram of Hydrocyanic acid is probably the minimum fatal dose, so that if an adult should eat 1·40 grams of the red variety fatal results might follow were it not for the fact that the gas is expelled by cooking. The absence of all but a trace of sugar is a characteristic of mature cassava tubers. The tubers analysed were about one year old.

	White Petioled Variety.	Red Petioled Variety.	Intermediate Variety.
Moisture	67·84	67·11	69·39
Ash	4·15	3·81	3·15
Starch (Dextrose × ·90) ...	24·88	25·79	23·82
Sugar	Traces	Traces	Traces
Dextrin	Traces	Traces	Traces
Crude fibre	1·795	1·816	2·27
Protein (Nitrogen × 6·25) ...	1·13	1·312	1·13
Hydrocyanic acid (bark) ...	·043	·046	·048
Hydrocyanic acid (edible portion)	·023	·028	·023
Undetermined	0·19	0·13	0·22

WATER FOR IRRIGATION AND STOCK.

J. C. BRUNNICH, AGRICULTURAL CHEMIST.

Every now and then reports are received from the country according to which crops have failed, soils have become unworkable and sterile, on using certain waters for irrigation, and again heavy mortality among stock has been caused by being forced to drink brackish water.

Analysis in such cases always demonstrates that the water was unfit for the use it was put to.

Numerous analyses of waters are carried out every year in our Agricultural Laboratory and many samples have to be condemned, and it is therefore of

the greatest importance that pastoralists and farmers should make use of the Department's services in all doubtful cases.

As it is quite impossible to give with each analysis full explanations of the terms used, and more particularly the reasons why certain waters are not suitable; and why it is practically impossible to improve or purify such waters by simple means, it will be of general interest to give here a few notes on water in general, and on the conditions under which waters are suitable for irrigation, or watering of stock in particular.

Water is one of the simplest chemical compounds, and consists of a combination of the two gases Oxygen and Hydrogen. It is very widely distributed, and nearly four-fifths of the surface of our earth is covered with water, to an average depth of about 12,000 feet.

Water is one of the most wonderful gifts of nature, and has been recognised as such since time immemorial. Life could not exist without it, as it enters largely in the composition of all living matter. Animal bodies contain from 40 to 70 per cent. of water, and plants even up to 90 per cent.

Chemically pure water is difficult to prepare, and is a perfectly tasteless and odourless liquid. Even distilled water, unless prepared with special precautions, will contain small amounts of impurities.

Water is a great solvent, and this property to readily dissolve gases, liquids, and solids is of great importance in the household of nature. Water left exposed to the air absorbs gases from the atmosphere, and rain water will therefore contain about 4 cubic inches of nitrogen, 2 cubic inches of oxygen, and one cubic inch of carbonic acid gas per gallon. If we compare these amounts with the composition of the atmosphere, it will be found that the ratio of composition has been completely changed, and in the atmospheric air we find 4 volumes of nitrogen to 1 volume of oxygen and only small traces of carbonic acid. This fact that the air dissolved in water is much richer in oxygen is of the greatest importance to the life of aquatic animals. The increased amount of carbonic acid increases its solvent action on soils and rocks.

Rain as it falls, not only dissolves gases, but collects other impurities as dust, bacteria, and also small traces of salt, ammonia salts, and other nitrogenous compounds.

Next to rain water the water from melting snow and ice, as found in mountain streams and lakes, and having passed only over hard crystalline rocks, is the purest water. As soon as rain water, or other water, passes through the soil, or layers of more soluble rocks,many mineral matters are dissolved, and change the character and taste of the water, which reappears again in form of springs, or is found in wells and bores. The water originally fresh water, containing only small amounts of mineral salts in solution, may have changed into a mineral water, containing large amounts of mineral matter.

Of such mineral substances dissolved the most important are:—

Lime salts, as calcium carbonate (*chalk or marble*) and calcium sulphate (*gypsum or copi*).

Magnesium salts, as magnesium carbonate (*common magnesia*), magnesium sulphate (*Epsom salt or salts*), and magnesium chloride.

Sodium salts, as sodium chloride (*common salt*), sodium sulphate (*Glauber's salt*), and sodium carbonate (*washing soda*).

The behaviour of water when using it for washing with soap gives a fair indication of the amount of mineral substances dissolved. Comparatively pure water, like rain water, readily produces a lather with soap, and is therefore called soft water. On the other hand, water containing lime and magnesium salts in solution, as frequently found in springs, wells, etc., are hard waters and when rubbed with soap appear to produce a curdy or flaky

precipitate, and only after considerable time a lather can be obtained. This action is a purely chemical one, caused by the mineral salts in the water decomposing the soap.

As a rule, a water of medium hardness, containing mineral salts and gases in solution, is more palatable and better for drinking purposes than a very soft water. For household purposes and factory use soft waters are generally to be preferred, as hard waters, besides leading to great waste of soap, on boiling and evaporation give cause to formation of boiler-scale; and some have a corroding action on metals.

One of the most pronounced mineral waters of nature is sea water, which contains about 3½ per cent. of solid matter in solution, three-fourths of which is common salt, or expressed in terms more generally used, sea water contains about 2,500 grains of total solids per gallon, of which 1,890 grains are sodium chloride or salt.

Water fit for drinking can be obtained from sea water by a process of distillation, as practised frequently at sea.

Salt, used in excessive amounts, acts like a poison, and therefore animals could not drink strongly saline or brackish water for any length of time.

Many of our well waters, and waters from shallow bores are saline, but fortunately the water from artesian bores are comparatively free from salt. Among about 180 analyses of bore waters, recorded in Dunstan's Queensland Mineral Index, only ten contained more than 100 grains of salt per gallon, and only six of these more than 300 grains.

The toleration of various domestic animals for salt has not been accurately determined, and will depend naturally on many circumstances.

We have records that water containing from 600 to 700 grains of salt per gallon caused heavy mortality among sheep, after using such water for a few months.

Water containing up to 300 grains of salt per gallon may apparently be used safely, although many animals will refuse to drink the water with even this amount. Should water contain from 300 to 600 grains of salt per gallon it should be used for watering stock, in case of absolute necessity, for short periods. Water with still higher amounts is absolutely unfit for stock.

With regard to the alkali carbonates, chiefly soda carbonate, very little is known of its effect on animals, and in the quantities usually found in artesian bore waters no harm appears to be done. Among 180 samples of bore water, already referred to, 109 contained up to 20 grains of sodium carbonate per gallon, the remainder containing more than 20 grains.

The maximum amount of salt recorded is 1,200 grains per gallon, and the maximum amount of sodium carbonate 576 grains per gallon.

The fact of our artesian bore waters being more or less alkaline is of greatest importance when such waters are intended to be used for irrigation, as alkali carbonates (sometimes called "Black alkali") have a very bad action on soil and destroy plant life at certain concentration. Such alkali acts on the humus and the clay in the soil, and often renders it unfit for cultivation, by making it puddle in wet weather, and causing it to dry up into hard cement-like masses after dry spells.

The amount of alkali carbonate to be tolerated in irrigation water depends largely on the quality of the soil, methods of cultivation, and frequency of the use of water.

Professor Hilgard reports a case from California, where orange trees were killed within three years, by irrigating them with a water containing 21 grains sodium carbonate and 63 grains salt per gallon.

At the Moree Experiment Farm, in New South Wales, opened in 1899 and closed in 1910, bore water containing about 45 grains total solids, of which 34 grains sodium carbonate, per gallon, was used, and even after eight years' continual use excellent crops of oaten hay, wheat, sorghum, and maize were grown. In this case the soil, a heavy black loam, contained about 1½ per cent. of lime. On lighter classes of soil the effect of irrigating with such alkaline water might not have been so successful.

No hard-and-fast rule can be laid down to judge the suitability of water for irrigation, but it may be accepted that a brackish or saline water containing about 100 grains total solids, chiefly consisting of sodium chloride, per gallon, is the limit for safe use under favourable conditions. The maximum amount of soda carbonate can be taken between 15 and 30 grains per gallon, according to the nature of the soil to be irrigated and amount of water to be used.

The injurious action of soda or black alkali may be counteracted to a large extent by heavy applications of gypsum to the soil.

The neutralisation of the alkali in the water with strong nitric acid has also been advocated, but will on account of expense be never of practical value. On a small scale, to grow a few flowers and vegetables with alkaline bore water irrigation, no other water being available, this treatment of water with nitric acid has proved successful in a few places. But even this treatment has its limits, as continual applications of water containing nitrates (saltpetre), although a great fertiliser, will similarly act on the soil as the alkali carbonate.

In all cases where alkaline bore waters are used for irrigation, the effects on soil and crops should be carefully watched, and the water should never be applied in excessive amounts. The ill-effects of mineral waters on plant life are chiefly due to concentration of the solutions in the soil, and even from waters containing only small amounts of mineral salts, dangerously high quantities may be left in the soil after repeated irrigation in hot, dry weather, which will not be removed until some heavy showers of rain have fallen and the ground is well drained and porous.

With regard to analysis of water, the results are generally stated in grains per gallon, and the first value given is the "total solid matter," left on evaporation of water. This solid matter may contain besides mineral salts organic matter and small amounts of combined moisture, which are driven off, on heating the residue to dull red heat. The difference in weight before and after heating is recorded as "loss on ignition."

The amount of "chlorine" in the water is given as such, and also calculated as sodium chloride or salt, although not necessarily all the chlorine is combined with soda, but may be present partially in form of magnesium chloride or calcium chloride. The "hardness of water" is expressed as lime carbonate, and when water is supposed to be used for boiler purposes the amount of temporary hardness, due to mineral matters being removed on boiling the water, and the permanent hardness, due to more soluble lime and magnesia salts remaining after boiling, are given. Any other alkalinity is recorded as sodium carbonate. When samples of water, intended for irrigation or watering of stock only, are taken for analysis, no special precautions, as recommended for drinking water, are necessary, and any ordinary clean bottle may be used, about a quart of water being required for analysis.

It would be of great interest to collect evidence throughout the State with regard to the use of alkaline and saline waters for irrigation and watering of stock. Any signs of disease in crops, or stock, should be carefully observed and reported to an inspector, who then could submit samples of the water in use for analysis, which would be made free of charge. In order to ascertain

the tolerated amounts of salt and alkali, inspectors should inquire into cases, where such waters are successfully used, and submit such samples of water for analysis from time to time. In many cases the salinity of well water diminishes after the well has been in use for some time, and all such facts are well worth recording and reporting.—QUEENSLAND AGRICULTURAL JOURNAL.

SOME CROPS OF THE BOMBAY PRESIDENCY.

H. L. VAN BUUREN.

The pulses have an interesting distribution. Tur (*Cajanus indicus*) easily takes the first place, but on the lighter sandy soils *Cyamopsis psoralioides* is worthy of note. *Tur* does best on the deep black soils: never elsewhere have I seen such magnificent crops attaining a height of about six feet. It is always grown mixed with cereals even with rice as a dry crop; sometime, it is drilled in rows. Drought in the early stages of the crop affects the subsequent growth but otherwise it is remarkably drought-resistant, rootings perhaps, deeper than any annual grown under cultivation. After the harvesting of a cereal crop the plants branch profusely and cover the ground with a thick mass of decayed leaves. The plant hybridises freely and the white colour of the pod has been found to be transmitted. The white-seeded varieties are considered best and are almost entirely confined to Gujarat.

Cyamopsis psoralioides is a plant never found out of Gujarat, in the Presidency. The plant does not thrive on clayey and very retentive soils. On the sandy soils under intensive cultivation it is valued as a green manure. The plants are used as shade for ginger where it grows to a height of about eight feet; the pods are used as vegetable, whilst the leaves are stripped off and left as green manure. When grown solely as a green manure crop the seeds are thickly broadcasted and when the plants are in full vigour of growth they are uprooted, the stems broken up, the leaves stripped off and scattered over the ground. Then the material is ploughed under. The plant, it must be noted, is a herb with very little of crude fibre.

Other pulses that thrive best only on black soils are *Tathyrus sativus*. *Dolichos lab-lab*, *Phaseolus mungo* and gram. On the light sandy soils, *Vigna catiang*, *Dolichos biflorus*, and *Phaseolus aconitifolius* meet with ideal requirements. *Tathyrus sativus* has the reputation of growing on the heaviest black soils even in waterlogged conditions and not being adversely affected when the soil shrinks and cracks on drying. It forms the food only of the poorest people: there is a considerable export of the grain to Zanzibar; habitual consumption of the grain is said to lead to paralysis of the lower extremities; the poisonous principle has been demonstrated to be an alkaloid which is volatile and can thus be destroyed by boiling.

Dolichos lab-lab is sown as a mixture with *jowari*, the stubble of which after harvesting is left three to four feet high whilst castors also are planted at intervals. These afford support to the climbers and the plants grow vigorously, giving a large number of pickings of beans from November to March. The crop is adversely affected by cold and the practice is to fence the field with *san* for protection. The *biflorus* species replaces this in light soils and is preferred for land in a very poor condition.

THE CULTIVATION OF OIL SEEDS IN GUJARAT.

The important part played by oil seeds in Gujarat agriculture cannot fail to impress a visitor to these districts. The castor-oil plant has a very intimate connection in all kinds of farming. In the rice area a cold weather

crop is taken after the harvesting of rice ; mixed with *Dolichos lab-lab* it forms the very best second crop to take where the soil still holds moisture. It is of interest to note the general belief that the oil of such a cold-season crop is better than that got when the crop is taken in the rainy season. The plant forms an integral part of any system of garden cultivation, affording very good shade. It can with profit be grown on sugar cane plantations and in such a mixture is allowed to remain for two seasons as long as the sugar cane lasts. In Surat the cane is planted in December and occupies the ground for thirteen months. The oil-cake* is the most valuable of the oil-cake manures used in the Presidency and finds a ready market.

The plant thrives best on river alluvials having a larger percentage of sand than clay. The oil seed *par excellence* of the light sandy soils is *Sesamum indicum*. The seeds mixed with cowdung and sand are generally sown by means of the indigenous seed-drill. This crop is grown during the rainy season and is rotated with cereals or grown in mixtures. It is interesting to note that it is the only oil seed that is widely grown as a pure crop. The profits are large, but the crop is risky, The proportion of the outturn to the seed-rate is in good seasons in the proportion of 1: 350.

The seeds always have a large demand and are used chiefly in native confectionery ; as a cattle-feed they are considered excellent for milch cattle. The white-seeded variety always command a higher price owing to the demand as mentioned above. The darker coloured seeds are used chiefly for oil extraction only.

Linseed takes the place of *sesamum* in the black soils. Though sometimes grown alone it is considered a risky crop ; besides, when grown alone the crop rarely branches and attains a height of nearly three feet, thus it presents conditions suitable for fibre ; when grown mixed, especially with wheat, the plants after the harvesting of the wheat crop branch freely and produce many capsules, thus being favourable as an oil-seed crop.

FIBRES IN GUJARAT.

San is grown extensively but chiefly for green manure. Its use as a green manure enters fundamentally into all agricultural practices as thoroughly as the use of a legume is recognised everywhere as essential in a rotation†. I was much interested in Deccan hemp (*Hibiscus cannabinus*). The climatic and soil requirements of this crop are not thoroughly understood. WATT‡ mentions its export to Calcutta as *Bimlipatam* jute and reviews the work of the Imperial Institute on the fibre which is found to be superior to jute and as strong as *San*. The plant occurs extensively in the mixtures mentioned in this paper and the fibre is appreciated locally. The plant does best with heavy rainfall and is therefore worth experimenting with in damper regions. The seed is valuable as a cattle feed.

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* This cake is said to have a beneficial action against white-ants. On the light soils of a sandy texture, white ants are perhaps the worst enemy of the cultivator, attacking all manner of crops. The black soils are unique in this respect as forming an uncongenial home for termites.

† This can be best illustrated by an account which shows that green manuring was practised early in the nineteenth century. MR. A. M. GREEN, the Assistant Collector of Surat brought to notice the insertion in an old report, dated 29th November, 1829, of the following (which was published in the POONA AGRICULTURAL COLLEGE MAGAZINE Vol. V. No. 2 p. 95).

"Urud or Phaceolus max. It is very meliorating crop, it does away the Exhanctness of the Ground. When a cultivator could not provide manure for his sugarcane cultivation, sow Urud in the first instance, and when the plant become about a feet high, he cultivates the land and mix the plant with the earth; it serves as a best manure, and produce an abundance of crop."

The extract is quoted as written in the original and is deserving of much wider publication than it likely has had.

‡ WATT'S. THE COMMERCIAL PRODUCTS OF INDIA.

TOBACCO.

The cultivation of tobacco has many interesting features. The soil characteristics appear to be everything that is desired: the wells that are used for irrigating tobacco have remarkable manurial properties. DR. LEATHER'S* work should be consulted for full details. According to his calculations the mixed water given from these wells supply during a season about 500 lb. of nitrate of potash per acre. Sodium chloride is also present in large quantities, but its effect has not as yet been demonstrated to be harmful.

The varieties of tobacco do not promise anything like a good quality of leaf. As long as climatic conditions for quality are little understood it is doubtful whether much improvement can be made. Foreign varieties have been tried and they all tend to approach the local varieties as they become acclimatised. The slow growth these varieties make under the Gujarat climate causes lateness of transplanting, thereby encroaching on the growing period which some here assert is too short for the proper development of leaf. The texture and grain of the leaf are good, but it tends to become too gummy, resinous and aromatic. The ash reveals a percentage composition too low of potash and too high of chlorine. Lime and sulphuric acid are also present in excess.

The work on tobacco is still in the experimental stage and efforts are directed towards the development of cigar fillers. The White Burley variety for cigarettes has met with some degree of success. A local variety known as Lanka grown near the Krishna river is reputed to be the best tobacco grown. I have not seen this type but the introduction of varieties might generally speaking, be said to be a complete failure. Work on hybridisation and plant selection has not begun as yet. In manuring it has been found that 20,000 lb. of farm yard manure with 1,000 lb. of castor-cake as a top-dressing gives the best results. It is asserted by some that castor-cake has a deleterious effect on the strength of the tobacco, which in this district is chiefly smoked in a *hukka*. This statement has not as yet been confirmed. Continuous cropping of the land with tobacco has been demonstrated to be better than any rotation.

FODDER.

The problem of fodder supply to cattle, so very acute on the trap soils of the Deccan, does not present such difficulties in Gujarat. Even on the alluvial black soils with a system of intensive cultivation many cultivators recognise the necessity of putting their land under grass or of reserving a small proportion of their land as grass land for the working cattle. On the dense soils I have noted that *Andropogon annulatus*, *Iseilema laxum* (?), *Isachue australis* are promising in the formation of pasture land. On the light soils *Andropogon sorghum var ceranus* (Sundhia jowari) is the best fodder crop. It does not do well on the black soils, and in the Deccan I note there is a tendency for it to run to fibre. Berseem has had a great success in Sindh but I do not think it would do well on light sandy soils from what I make out of the experiments with it in Gujarat. It must be remembered that with the excellent organization against famine, there is an impossibility of people actually dying of starvation. The danger now to be combated in long periods of drought is the loss of agricultural cattle through starvation ; on the light sandy soils where cattle famines are the result that of inconstant rainfall experiments have been conducted on useful emergency fodders to ascertain (1) rapidity of yielding (2) quantity of outturn per area and (3) cost of production.

These show that *Sundhia jowari* is ready to cut two months from the date of growing and can be sown any time up till the end of August ; in the cold weather, where the minimum temperature falls to about 50 ° F., this crop does not do well.

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* AGRICULTURAL LEDGER, No. 14 of 1895.

Panicum miliaceum and *Setaria italica* do well in the cold weather, but the latter is by far the better crop, giving a better yield exceeding the latter by nearly 75 per cent. Lucerne would do better provided it is sown not later than the middle of November; the crop should be ridged and the first cutting would be given within 10 weeks. The straw of *Eleusine coracana* is never fed to milch cattle because it has been observed that the milk flow is reduced. Its effect is decribed as heating.

HEVEA AND COFFEE CATCH CROPS IN JAVA.

WYNAENDTHS VAN RESANDT.

Although an article re coffee matters is not in its proper place in a rubber journal, I think the fact that many of your readers have interests in Java estates justifies the subject of this contribution.

It is known that many rubber estates, especially in East Java, are interplanted with other products such as coffee, cocoa, etc. The best catch crop is, in my opinion, coffee robusta. I know that the idea of transplanting rubber with an catch crop is very averse to many English planters in the Straits and F. M. S. Also in Sumatra planters prefer a pure rubber estate without any interplantings. So do I. But I want to make clear to foreign planters, not residing in Java, why Java rubber estates have been interplanted with catch crops.

Just before the rubber boom the price of rubber was very high and Java coffee planters, who were doing very badly in Java coffee, planted Hevea, Rambong and Ceara in their coffee gardens wherever possible. They cultivated both Hevea and coffee, and when the rubber boom came many of these estates were sold as rubber properties. Later on the shade for the coffee was cut out as the Java coffee was gradually replaced by Robusta coffee, and the latter did not want dense shade or any shade at all in the beginning.

After the shade was cut out the rubber trees were growing better; Hevea supplies were planted and the whole looked much more like a rubber estate than before. This was the origin of many of our rubber estates. Nevertheless, many rubber estates were also started on virgin soil and purposely interplanted with Robusta coffee. Many English directors or shareholders visiting Java at that time wondered why the Dutch planters were transplanting coffee while the rubber market was so good. They were against coffee interplanting, as the growth of rubber was kept back by the coffee. At the present moment I imagine the directors and shareholders of Java rubber companies are very thankful that there is still Robusta coffee growing on their estates. If it was not for the Robusta coffee I am sure many rubber estates would have been closed at the present time.

Straits and F. M. S. planters cannot compare Java estates with their own. When they had to start tapping the price of rubber was still 8s. to 10s. per lb. What did it matter at that time that the cost price was high, and production was small? With such a high price for rubber the estate could afford it.

The Java estates came into production years later, when the price was already down to three shillings per pound.

At that time we could only tap the trees at a big loss, and if the Robusta coffee had not helped us we would certainly have been in a very serious position.

I know of estates in Java where every year 10,000 piculs of Robusta coffee are harvested. Last year the average price of coffee, all grades included, was 45 florins per picul. Some companies sold their first grade coffee at Fl. 48 per picul on forward contract.

At present the price has dropped, but it is still plus or minus Fls. 28—the average of coffees sold at Sourabaya, while the cost price, everything included, c.i.f., Sourabaya, is not more than Fl. 10 per picul. An estate as above mentioned makes on coffee alone a profit of F. 18.000 per year. Even taking into consideration that the growth of the rubber trees has been retarded, the interplanting of Robusta coffee has proved a commercial success. I especially want to point out this fact, as many English planters have thought the Dutch very foolish in planting catch crops. If the planting distances are responsible the growth of rubber is not kept back so much as one might imagine. The best planting distance is, in my opinion, Hevea 24 ft. × 24 ft. and coffee 8 ft. × 8 ft. ; the coffee trees do not then come nearer to the Heveas than 8 ft.

BEST COFFEE DISTRICT.

The Banjowangi district (East Java) has given the best results with Robusta. On an average in the 3rd and 4th year 20 to 25 piculs of coffee per bouw ($1\frac{3}{4}$ acres) have been harvested. Some gardens have even yielded 35 piculs of coffee per bouw.

On other plantations the results have not been so good, but in many places coffee Robusta has been planted where there was no chance of success. The idea that coffee Robusta can substitute Java coffee on all estates is quite wrong.

Java coffee has very much degenerated during the last ten years, and on estates with a big rainfall the crops have always failed.

Robusta coffee is a plant which grows very well and yields large crops on those estates where the rainfall is good, but on dry estates the crops are very disappointing.

Java planters, although for the moment still satisfied with Robusta coffee, are always on the look out for new varieties.

As mentioned above the Java coffee degenerated so much that it had to be replaced by another kind of coffee, which could stand the influence of climate and also disease. The leaf disease was the main enemy of Java coffee. This coffee was much stronger and could withstand for some time, the disease mentioned. The substitute of the Liberia was coffee Robusta, mainly as a catch crop. Besides coffee Robusta the Quillou and Uganda, which belong to the same family as the Robusta, are also planted as a catch crop, and Java planters are still experimenting with these kinds. It is already proved that the Quillou coffee is growing better on dry estates with a pronounced clay formation than coffee Robusta.

The root system of the Quillou coffee is more developed than that of Robusta, and goes deeper in the ground ; this is probably the main reason why Quillou can stand the drought better. The type of Quillou is very regular, with a good spreading of branches. It must now be considered on which estates it is advisable to plant Robusta and Quillou respectively.

VARIETIES OF COFFEE.

The following kinds are of interest :—

(1) *Congensis, origine Africa.*—This coffee gives a good production, but is less suitable as a catch crop as the trees want much sunshine. Best plant distance 7 × 8 feet.

(2) *Excelsa, origine Africa (Belgian Congo).*—Also unfit for being used as a catch crop, but gives good results when planted alone.

(3) *Laurentiie, origine Africa.*—This specimen grows very regularly and is by far the best of the three kinds : it is a good producer and fit to be used as a catch crop.

There are, of course, many more varieties, but those mentioned are the most important in addition to Robusta and Quillou.

Perhaps Laurentiie will take the place of Robusta when the latter fails in future.

LIFE OF COFFEE.

Coffee as a catch crop will disappear gradually on rubber estates ;. first on estates at a low elevation. After the rubber trees begin to give denser shade the coffee will not give such good yields and might gradually be cut out. In the meantime the rubber has come into production and when the last coffee tree is cut out the rubber estates will be in full bearing. By that time our cost of production will be low and we can finance our estates without the help of Robusta coffee.

The life of Robusta coffee on estates of a low elevation might be put at 8 to 12 years ; on estates at high altitudes at 12 to 18 years. No one thinks at the present time of extending rubber plantations, and coffee is therefore planted as a catch crop, but as a culture by itself with good financial results.

My main objects in writing this article have been :—

(1) To secure in England for our Java coffee the good name and importance which it deserves ; and

(2) To give foreign shareholders in Java rubber estates more information re coffee planted as a catch crop than just the number of piculs harvested and the dividend paid.

I hope I have succeeded in this.—INDIA RUBBER JOURNAL.

QUININE.

As we noted several months ago, the price of quinine, to the surprise of many people, has been practically unaffected by the war, and the future outlook as regards market conditions remains obscure. Statistically the position is judged to be good enough for a higher level of values, but the war has brought about abnormal and unforeseen conditions which preclude the expression of any opinion as to the future. Recently there appears to have been a fair amount of quiet buying in the second-hand market, the value of good brands of Continental sulphate being about 1*s.* 2*d.*, and there is no official German makers' quotation. The annual reports and statistical information which have been issued by the Amsterdam and London brokers (including MESSRS. H. A. VAN OVERZEE, P. BRUSSE, G. BRIEGLEB, PEX & DAVIDS, DOMEIER & CO., and WIDEMANN, BROICHER & CO , LTD.) enable us to give a short survey of the position of bark and quinine during 1914. The last-named firm in their report state that—

Markets followed a normal and, for bark-growers and quinine-makers, no doubt satisfactory course until the outbreak of war in August. The export of bark and quinine from the United Kingdom was then prohibited, and the same step was taken in Holland, which country, however, removed the embargo in September. England followed the Dutch example in November, probably in recognition of the small local consumption of quinine and the Colonies' urgent requirements; exports have since been on a fairly large scale. Germany has likewise prohibited the export of quinine and preparations, but, judging from American reports, German makers appear to be in a position to offer in the United States. The sales of quinine in the bark during 1914 were about 56,000 kilos.—less than in the preceding year, and smaller than in any year since 1906 with the exception of 1912, the

year of intensive negotiations for the cinchona agreement. The German quinine-makers' requirements have probably been curtailed by partial export prohibitions, and the results of the London bark-sales revealed anything but urgent requirements on the part of the English makers. The unit-price in Holland has throughout been maintained at 6·20c., pointing to the continuance of the cinchona agreement, and an unaltered first-hand price for sulphate in Germany of 1*s.* 1*d.* per oz. . . . Statistically the position remains favourable. It is true that the Java production of bark is greater than the quantity supplied to the quinine-makers under the agreement, and that that quantity is larger than the present total consumption. Bark stocks in Holland have not increased meanwhile, but no doubt there are large stocks in Java, which will not, however, affect the position unless and until circumstances arise to terminate the cinchona agreement. . . . The Java shipments have fallen off considerably, being about four million pounds less than in 1913. Ceylon exports are negligible; India has sent about 70 per cent. more bark than in 1913, stimulated no doubt by prospects of better prices. The London quinine stock has experienced a reduction of about three-quarters of a million ounces. The second-hand quinine market, confident of an impending rise in the official price, was very steady from January to July, the spot price ranging from 1*s.* to 1*s.* 0¾*d.* In August the price advanced to 1*s.* 2½*d.*, but, business being checked by export prohibitions, great calm ensued, the value receding to 1*s.* 1*d.*, and recovering but little after the removal of the embargo. At the end of the year the price was 1*s.* 0¼*d.* in second-hands. Large quantities of Dutch were imported into London.

Looking further into the statistical position, we note that the exports of bark from Java to Europe are the lowest since 1906, when the official price of German quinine ranged from 7½*d.* to 10*d.* per oz.; on the other hand, imports of bark into the United Kingdom for the past six years show extremely little variation. The Amsterdam stock of bark is very large (68,500 packages) compared with previous years—*e.g.*, in 1901 it was only 13,100 packages; 1902 to 1904, 15,000 to 17,000; 1905, 39,000; 1906 to 1911, 18,000 to 28,000; 1912, 53,000; and 1913, 70,300 packages. The range of unit at the London bark-sales was from 1¼*d.* to 1½*d.* per lb., while at Amsterdam the unit was unchanged throughout at 6·20c. per half-kilo., against 4·14c. to 5·60c. in 1913. The average percentage of quinine in the manufacturing-bark offered at Amsterdam last year was 6·03, or the lowest since 1907. It is of interest to note that the London stock of quinine on December 31 was 2,702,363 oz., or about 706,000 oz. less than in 1913, and lowest for at least the past thirteen years. Last week we referred to the fact that the Indian Government have prohibited the export of bark, but this fact will not influence the situation. Some interesting statistics regarding the imports of quinine and alkaloids into India are given in the annual review of the trade of India in 1913-14, just published.

These figures are for the official year ending March 31, and are as follows:

1912-13	1913-14
1,680,000 oz.	1,872,000 oz.
£72,000	£102, 000

It will be seen that the increase in 1913-14 is 192,000 oz., or 30,000*l.*, a respective increase of 11·4 per cent. in weight and 43·2 per cent. in value. Taking the average for the three years ended 1911-12, we find the imports were 125,000 lb., or 2,000,000 oz., the average value being 71,000*l.* The declared import-value in 1913-14 was 17*s.* 6*d.* per lb., or 1*s.* 1*d.* per oz., compared with 13*s.* 7⅝*d.* in 1912-13 and 12*s.* 2⅔*d.* in 1911-12.—CHEMIST & DRUGGIST.

CASTRATION AND MULLING.

Superintendent WARE of the Civil Veterinary Department, Madras, contributes an article on this subject to the INDIAN AGRICULTURIST of December last. He says :—These operations are performed on male animals, in order to render them useless for breeding purposes and unable to beget their own kind. Castration consists in the removal of the animal's testicles, and should therefore not be attempted by anyone but a trained expert.

By "mulling" is meant the destruction, without removal, of either the testicles or spermatic cord or both, thus rendering the animal sterile. This barbarous operation of mulling is probably too well-known by everyone to need description, but it might be mentioned that, as performed in the villages in this country, it consists in hammering or otherwise macerating the animal's testicles until they are reduced to a pulp. The operation usually takes about half-an-hour, the animal the whole time suffering the most excruciating pain. Of course, one has to realise that to make animals tractable and render them fit for doing man's work, it is necessary to perform some operation of this kind and until a few years ago there was no one in this country, except in a few big towns, who could perform the scientific operations of castration. In former years therefore there certainly was some excuse for "mulling" animals, but now that Government has supplied each district in this Presidency with at least one itinerating Veterinary Assistant, who, in addition to his other capabilities, has been trained to perform castration, it is a disgrace for the enlightened inhabitants of a civilized country to continue to allow their animals to be "mulled." The chief advantage of castration over mulling may be briefly enumerated as follows :—

(a) Mulling takes half-an-hour to perform, while the actual operation of castration should not take a skilled man more than five minutes.

(b) If castration is performed when the animal is young in the case of a horse, he will be fit again in fourteen days, while other animals, such as cattle and sheep, may be sent back to the herd at once and no more notice taken of them. The after-effects of mulling will, even in the case of cattle often last for weeks, and an abscess frequently forms at the seat of operation.

(c) As the testicles are completely removed in castration it is obvious that the animal must be rendered completely sterile. Although this is the object aimed at in mulling, yet owing perhaps to the animal being released from the pain he is undergoing a little too soon, it is not always attained and the animal remains a nuisance to everyone during the rest of his life, unable to perform the covering act properly but having sufficient sexual instinct to worry and tease females in oestrum.

(d) As the operation takes such a very short time, it is not usual in this country to give chloroform to an animal about to undergo castration ; but should the owner so desire, this can be done by the Veterinary Assistant and the animal will then be rendered absolutely insensible to pain. There is a mistaken idea prevalent in this country that bulls should not be castrated or mulled until they are over two years old ; in many cases they are not done until three or four years of age. The reason given by ryots for this custom is that castration if performed early stunts an animal's growth. What really happens is that if a bull is not castrated, he tends to grow coarser and heavier about the neck and hump, whereas if castrated early, the nutrition which would otherwise go to increasing the size of the forepart of his body is now distributed more evenly and he grows taller and is far more lithe and active when he attains maturity. The best age to perform the operation of castration in the different domestic animals is as follows :—

Horse and Donkey	...	1-2 years.
Cattle	...	3 months—1 year.
Sheep and Goats	...	1-3 months.

A GOOD AND CHEAP WHITEWASH.

The Department of Agriculture of New South Wales recommends the following as a cheap white-wash which will stand the rain and weather without coming off, and will do for galvanised iron :--Place enough tallow required for the purpose in a large bucket ; then lay about the same quantity of good lime (dry) on top of the tallow—i.e., equal proportions of each ; then pour enough water on to slake the lime. When the heat from the lime has melted the tallow, and all is well dissolved, stir it thoroughly until all is well mixed ; then apply (warm, if possible) with a large brush This will do for any surface. The surface must be quite dry before applying the mixture. If required to dry very white, add a small quantity of blue.—QUEENSLAND AGRICULTURAL JOURNAL.

YOUNG RUBBER AT GANNORUWA.

Tephrosia Candida has been cut and mulched for the seventh time in the new Hill Plantations. The soil around the trees was lightly forked before applying the mulch. A good rainfall taking place after this was done, the roots should have plenty of moisture conserved to carry them through the dry weather.

Several planters who have seen these plantations have been very favourably impressed with the system of cultivation and at the remarkably healthy appearance of the trees.

D. S. CORLETT.

WEDGE-GRAFTING.

The Superintendent of the Lucknow gardens recommends recourse to wedge-grafting with scions of the female papaw on the male. This is done by removing young lateral shoots found on the female after the first year, especially if the tree has had its top removed, and grafting these on young male plants. It is necessary that the shoots should be about the same size as the stem of the stock.

C. D.

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Guinea fowls **Rs. 48,** Pigeons **Rs. 6,** Partridges **Rs. 6,** per dozen. Quails to order.

Pigs, Porkers, **cts. 35** per lb. live weight, Sucklings **Rs. 7·50, 5** and **3.**

Eggs, fresh, **75 cts.** per dozen.

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TROPICAL AGRICULTURE.

The proceedings of the Third International Congress of Tropical Agriculture, which have just been published (London: JOHN BALE, SONS and DANIELSSON, 10s. net), form a substantial volume of over 400 pages. The volume is edited by the Honorary Secretaries of the Congress, which, it will be remembered, was held last June at the Imperial Institute. This was the first time the Congress had been held in London, and the result was most successful. More than 150 papers, coming from authorities in fifty different countries, were presented to the Congress, and important discussions took place on several of the principal problems connected with tropical agriculture. Abstracts of the papers and full reports of the discussions are printed in the "Proceedings," together with the address delivered by the President of the Congress, PROFESSOR WYNDHAM R. DUNSTAN, C.M.G., LL.D., F.R.S., Director of the Imperial Institute, and President of the International Association for Tropical Agriculture.

Amongst the subjects dealt with in the Proceedings are Technical Education in Tropical Agriculture: Organisation of Agricultural Departments in Relation to Research; Agricultural Credit Banks and Co-operative Societies; Sanitation and Hygiene on Tropical Estates; Legislation against Plant Diseases and Pests; Fertility of Soils in the Tropics; Variation in Plantation Rubber: Cotton and Cotton Cultivation; Jute and Hemp Fibres; Cereals; Sugar; Cocoa; Tobacco; Oils and Oil Seeds.

The speakers taking part in the discussions included the Right Hon. Lewis Harcourt, M.P. (Secretary of State for the Colonies); Earl Kitchener, the Earl of Derby, Lord Emmot, Sir George Reid, Sir Hugh Clifford, Sir Horace Plunkett, Sir Ronald Ross, Sir H. Hesketh Bell, Sir Sydney Olivier, Sir E. Rosling, Mr. R. N. Lyne, Dr. H. M. Fernando, Mr. F. Crosbie Roles, Mr. G. H. Golledge, Mr. James Peiris, Mr. E. E. Green, and a large number of authorities on tropical agriculture from all over the world.

This book thus forms a valuable record of expert opinion on all the more important problems of Tropical Agriculture and Colonial Development, which at the present time are of particular interest.

AGRICULTURE IN CYPRUS.

Although the country is dependent solely on agriculture, the methods in use are very primitive and the implements rudimentary. The backwardness of agriculture is attributed to ignorance, lack of enterprise and lack of credit organization. For example, the Cypriot peasant is so ignorant of the value of farm manure that he disposes of it—since the Government has prohibited its exportation—by selling it at an absurdly low price to the few farmers who are more clear-sighted. The plough in use is of the same kind which has been used for centuries, and breaks at the least shock. Credit is in the hands of usurers, from whom the cultivator is generally obliged to borrow before his crops are ready, at a rate of interest from 30 to 60 per cent. Such are the reasons that have prevented progress in agriculture notwithstanding projects for banks and co-operative societies and the persevering efforts of the Government and the Department of Agriculture.

The British officials, notwithstanding the difficulties of working against reactionary tendencies, have commenced the improvement of the conditions of agriculture by educating the young generation of cultivators and by the demonstration of modern methods and of the use of efficient implements

and machinery. Slowly the new ideas have made headway and already the good effects of devoted effort may be seen. A model and experimental farm has been established at Athalassa, near Nicosia, where Cypriots may see their familiar crops produced by the modern system of farming, and by the use of fertilisers and improved implements. The work of the Cyprus Stock Committee has resulted in a marked improvement in the breed of horses, cattle and donkeys. The plague of locusts has been successfully combated.

Cyprus is essentially an agricultural country and is favourably situated for supplying the markets of Egypt, Syria and Asia Minor. The principal economic products of the island are barley, wheat, oats, vetches, carobs, grapes, raisins, wine, silk, olives, cotton, sesame, aniseed, linseed, hemp, black cumin, beans, lentils, fruit and vegetables.—CHAMBER OF COMMERCE JOURNAL.

EASTERN DYES.

The INDIAN TRADE JOURNAL of February 11th contains an interesting note on Dyeing Values of Some indigenous Dyestuffs.

The following are the chief of their dyeing agents which are also found in Ceylon :—

Nyctanthes arbor-tristis (S. Sèpâlika). The brilliant yellow colouring matter in the flowers is soluble in water and alcohol. (2) *Butea frondosa* (S. Magul karanda). The yellow colouring matter is contained in the flowers, and with wool dyes brown to dull crimson. (3) *Curcuma longa* (S. Kaha). A bright yellow dye is obtained from the rhizom s which are commonly used as turmeric in Eastern cookery. It is freely soluble in alcohol and also hot water. (4) *Adhatoda vasica* (S. Ardathoda). The leaves yield a yellow dye soluble in water and also in alcohol. (5) *Punica granatum* (S. Delun). This is the pomegranate, the rind of which produces a yellow colouring matter which dyes wool brown. (6) *Tephrosia purpurea* (S. Pila) has a yellow dye in the leaves. (7) *Cæsalpinia sappan* (S. Patangi) : crimson and purple dyes are obtainable from the wood of this common fence plant. (8) *Rubia cordifolia* (S. Yogana-wel or Velmadata), the roots of which afford a valuable red and maroon dye. To these might be added *Lawsonia alba* (S. Marithondu), the leaves of which give a reddish dye.

Another possible source of dye is lac, which on being washed with a weak alkali parts with its colouring matter, which can be precipitated by means of alum and afterwards pressed into cakes. It yields beautiful scarlet and crimson shades.

C. D.

According to the WEALTH OF INDIA, the export of rice from Burma in 1913-14 was 2,744,236 tons, valued at 2,582-10 lacs of rupees. The rice grown for export is raised chiefly in lower Burma.

The above figures represent 66 per cent. of the total value of all merchandise exported. While shipments to the United Kingdom, Continental Europe and the Far East declined, those to Ceylon, Africa and America increased. Ceylon being unable to satisfy her requirements at her usual Indian markets had to go further afield.

C. D.

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[*Photo by H. F. Macmillan.*]

COCONUTS AT EXPERIMENT STATION, PERADENIYA.

A prolific 7-year old coconut palm at the Experiment Station, Peradeniya.

Height of trunk to the bud ...	... 9½ ft.
Girth at 2 feet from the ground	... 4 ,,
Number of nuts on tree at time of photographing	... 179
,, ,, bunches bearing nuts	... 13
Number of nuts in largest bunch	... 33
,, of unopened flower stalks	... 2
,, ,, opened flower stalks	... 5

The above records are interesting as the Experiment Station is about 1,600 feet above sea level; *i.e.*, at least 1,000 feet above the coconut belt proper. A common supposition is that coconuts will not thrive beyond the limits of the sound of the sea, but the site of the above is about 55 miles from the sea as the crow flies. This plantation is regularly ploughed and harrowed for conserving the moisture on Dry Farming principles.